

FINAL TECHNICAL MEMORANDUM
SUMMARY OF THE JUNE 2019 FISH SAMPLING EVENT
SMURFIT-STONE/FRENCHTOWN MILL SITE, MONTANA

1.0 INTRODUCTION

This memorandum summarizes the fish sampling effort conducted by the U.S. Environmental Protection Agency (EPA) Region 8 (Mountains and Plains) in June 2019 to support human health and ecological risk assessment efforts at the Smurfit-Stone/Frenchtown Mill Site (Site). The primary objective of this fish sampling effort was to collect information on chemicals of interest (COIs) in tissues of game fish collected from the reach of the Clark Fork River (CFR) included in Operable Unit 3 (OU3) of the Site to use for assessing potential risks to people and ecological receptors within the risk assessments. In addition, fish samples were collected from upstream locations to address a data gap identified by EPA for a reference dataset. One objective of this memorandum is to document sampling and processing deviations that occurred during the 2019 fish sampling event. A similar fish sampling event was completed in 2018. Field deviations associated with the 2018 sampling event were previously reported in EPA (2019b). The other objectives of this memorandum are to summarize the 2019 and 2018 fish tissue analytical results and evaluate how the data based on the two separate sampling events compare to one another.

2.0 SUMMARY OF 2019 FISH SAMPLING

2.1 Overview

As described in the EPA Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) (EPA 2019a), the 2019 fish collection effort was conducted to address a data gap identified by EPA for evaluating human health and ecological risks associated with the fish consumption pathway. Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzo-p-furans (PCDFs) (referred to herein as “dioxins and furans” and abbreviated as D/Fs), and polychlorinated biphenyls (PCBs) can bioaccumulate in the tissues of higher trophic level fish. Initial risk estimates presented in the draft human health risk assessment (HHRA) for OU3 using fish tissue data collected by Montana Fish, Wildlife and Parks (MFWP) in 2013 suggested that the consumption of locally caught fish from the CFR adjacent to and just downstream of the Site may result in an elevated risk associated primarily with the ingestion of PCBs (as Aroclors) in fish tissues (EPA 2018a). Due to several data limitations with the 2013 fish tissue data (i.e., small samples size, limited scope, skinless fillets, lack of third-party validation), these initial risk estimates were considered uncertain. EPA determined that additional fish tissue data were needed to address uncertainty in risk estimates for humans consuming fish caught from the CFR and to further characterize D/F and PCB concentrations in fish tissues collected from the CFR. It

was also determined that appropriate background data were lacking, and additional fish tissue data were needed upstream of the Site (inclusive of upstream tributaries).

In 2018, EPA in cooperation with MFWP collected northern pike (NP) and rainbow trout (RB) from the CFR and its tributaries in accordance with the EPA SAP/QAPP (EPA 2018b). EPA (2019b) summarizes the sampling deviations associated with the 2018 fish sampling event. Due to missing chain-of-custody (COC) forms and associated field quality control (QC) samples for the 2018 sampling event, EPA decided to collect additional fish in 2019 to ensure that the data gaps and uncertainties in the risk assessments were addressed in a manner that complies with applicable data quality requirements, and to allow for the evaluation of temporal variability in fish tissues. The same sampling locations identified for the 2018 fish sampling event were targeted for the 2019 fish sampling event. An updated SAP/QAPP was developed and approved by EPA in 2019 to guide this sampling effort (EPA 2019a). The 2019 fish sampling event involved multiple agencies and support services/contractors. Roles and responsibilities of each group are specified in the QAPP. During the period between June 17-21, 2019, the MFWP field team collected RB and NP from the CFR and its tributaries in accordance with the EPA SAP/QAPP (EPA 2019a). The 2019 SAP/QAPP directed the collection of 20 RB of a target length between 250-350 mm and 20 NP of a target length between 500-760 mm (or greater) from each of the reach locations shown in Figure 2-1.

During each daily sampling event, MFWP returned to the riverside fish processing area following the collection of fish. MFWP staff transferred the fish from the boat live well to a live cart for field processing. Collected fish were received by the Hydrogeologic, Inc. (HGL) field processing team who rinsed (ambient water and deionized [DI] water), inspected, measured and weighed each fish before wrapping in foil, labeling, bagging and storing on ice for transport to the local processing facility (office space in Superior, MT). Throughout the week, MFWP selected sampling reaches to target the species and sizes of fish needed, as well as reaches needed, to comply with the 2019 SAP/QAPP (EPA 2019a).

At the field processing facility, fish were filleted within specified holding times in accordance with EPA (2019a). Fish were processed throughout the week on an ongoing basis, as they were received from MFWP. Individual wrapped frozen tissue samples identified for each composite were grouped together and clearly labeled within each cooler per EPA (2019a). Fillet and carcass tissue samples, and field QC samples were shipped in sealed coolers with dry ice and signed COC forms via FedEx overnight to EPA's Environmental Services Assistance Team (ESAT) point of contact in Denver, CO. Upon receipt, ESAT staff inspected the coolers to make sure that the proper temperature was maintained during shipping, that the coolers were intact and sealed, and that the number of samples in the coolers matched up with the information provided in the COC forms.

Samples were stored at the ESAT laboratory frozen at less than or equal to (\leq) -20 degrees centigrade ($^{\circ}\text{C}$) until time of laboratory processing to create homogenate samples for analysis. Tissue homogenate samples for each composite were created in November/December 2019 in accordance with EPA (2019a). Fillet and carcass homogenate samples, field QC samples, and processing QC samples were shipped in sealed coolers with wet ice at $\leq 4^{\circ}\text{C}$ along with COC forms via FedEx to ALS Environmental. Upon receipt, an ALS representative inspected the coolers to make sure that the proper temperature was maintained during shipping, that the coolers were intact and sealed, and that the number of samples in the coolers matched up with the information provided in the COC forms.

The laboratory analytical reports were submitted to EPA's contractor Weston Solutions (Weston) in Lakewood, CO. Weston contracted the services of MEC^x to provide third party validation of the tissue data.

2.2 Sample Summary

Table 2-1 summarizes the fish collected by MFWP in 2019. As shown, a total of 41 NP and 100 RB were collected. Where possible, fish were grouped into composite samples based on their lengths to meet the QAPP requirements of being within 75 percent (%) of the length of each individual within the composite. Table 2-2 summarizes the fish homogenate samples created by ESAT and submitted to ALS for analysis.

Table 2-3 summarizes the field QC samples and Table 2-4 summarizes the sample processing QC samples submitted by ESAT for analysis.

3.0 2019 FIELD AND SAMPLE PROCESSING DEVIATIONS

Field programs for the collection of biological samples always contain a degree of inherent uncertainty. This is particularly true for the collection of fish, which move through river systems at will. Targeted fish species, fish sizes, and sampling locations specified in the 2019 SAP/QAPP were based on risk assessment data needs, but also considered local knowledge of the CFR ecosystem. Below, deviations from field sampling and laboratory processing of fish are described.

3.1 Field Sampling Deviations

In general, sampling deviations are not unexpected as it is not uncommon to find that field conditions at the time of sampling (e.g., weather, hydrology, available habitat) are different from

expectations. As a result, changes in sampling strategy must be made from the approach outlined in the SAP/QAPP to adapt to those conditions. Field sampling deviations for the 2019 fish sampling event are described.

3.1.1 Number of Fish Collected

As discussed in EPA (2019a), the goal of the sampling effort was to collect 20 fish of each species per reach, with the goal of preparing four composite samples comprised of five individual fish each. As shown in Table 2-1, this goal was not achieved at every reach. Specific deviations are described in this section below.

No sampling was conducted at the Clinton (CLN) or Greenough (GRE) reaches. Several days prior to the start of sampling, MFWP indicated to EPA that river flow conditions would not likely support access within these reaches due to low water levels that would restrict the ability to utilize their sampling equipment (i.e. 18' Wooldridge center console boat with a 200 horsepower [hp] Evinrude E-Tec outboard motor). EPA's response was to not eliminate these reaches *a priori*, but instead to monitor river conditions throughout the sampling event and to attempt to sample these locations considering alternative sampling approaches if feasible (e.g., drift boats, rafts, or backpack electrofishing equipment). Ultimately, MFWP did not consider other sampling approaches feasible and these reaches were not sampled. Comments submitted to EPA questioned the justification provided by MFWP noting that CFR flows at the USGS gauging station above Missoula registered a flow of 5,300 cubic feet per second (cfs) on the first day of sampling (6/17/19) when MFWP decided to not sample these locations. Commenters noted that these flow conditions were similar to the lower flow condition measured in 2018 (5,590 cfs) when sampling of the Greenough location was conducted.

Aside from the CLN and GRE reaches, 20 RB were collected from all other reaches specified in the 2019 SAP/QAPP. Of note, only 19 RB were collected for processing on the initial sampling of the Frenchtown (FRN) reach on 6/19/19 even though MFWP had transferred 22 RB caught from the FRN reach to HGL. Three RB which were greater than (>) 400 mm were released. Based on the need for 20 fish from the FRN reach, MFWP returned to this reach on 6/21/19 to collect an additional RB specimen at the request of EPA.

Following collection of RB from the FRN, Council Grove (COG), Missoula (MIS) and St. Regis (STR) reaches, MFWP indicated to EPA that only one NP was able to be collected from the FRN reach and that additional NP could not be collected from these reaches. MFWP noted that as the river level drops, the back waters and sloughs that provide good habitat for NP are comprised of less river water and more groundwater. The conductivity of the groundwater is much higher (up to 1,350 millisiemens [ms] compared to 170 ms) and limits the ability to catch NP with the

typical, preferred and recommended electrofishing settings (straight direct current [DC]). EPA requested that MFWP return to these reaches and attempt conducting NP-specific electrofishing to meet the sampling goals. MFWP re-visited these reaches and adjusted the combination of frequency and duty cycle on the electrofisher which resulted in the collection of 20 NP from the FRN reach and 1 NP from the COG reach. No NP were collected from the MIS and STR reaches.

3.1.2 Size of Fish Collected

The SAP/QAPP specified target lengths of RB and NP of 250-350 mm and 550-760 mm or greater, respectively. These target sizes are consistent with sizes of fish primarily caught by recreational fishers.

Table 2-1 includes the size ranges of the fish collected during the 2019 sampling event. As shown, RB were either within the target size range or larger. NP were all greater than 550 mm in length except for one specimen collected from the Lolo (LOL) reach that measured 470 mm.

3.1.3 Field Processing

Comments submitted to EPA after completion of the sampling event noted potential concerns with field processing of fish related to the transfer of fish from MFWP to HGL and fish handling on the shore, as follows:

- The live cart used to hold the fish prior to field processing was constructed of open mesh fabric and was placed in shallow water directly on river sediments in an area where sediments may contain elevated concentrations of dioxins due to the loading and offloading of boats at the public boat ramp locations.
- Fish were not euthanized with a sharp blow to the back of the head per the QAPP which resulted in fish flopping around during handling and being dropped on at least two occasions.
- One fish collected on 6/19/19 was observed by the PRP representative to have flopped into the crack of the truck tailgate and was not subsequently rinsed prior to processing.
- HGL performed fish length measurements and wrapping/bagging on the tailgate of a pickup truck or the lid of a cooler at the boat launch sites. These areas were not sheltered from dust potentially generated by vehicular traffic at these launch sites.
- On at least one occasion, staff did not wear nitrile gloves to handle the fish and the ruler used to measure the fish was not rinsed/decontaminated between fish samples.

3.1.4 Field QC Samples

Per EPA (2019a), one field blank per reach should have been collected by the MFWP field team during sampling and one rinsate blank per 20 fish should have been collected during field processing. All field blanks should have been collected in amber glass jars as 1-liter (L) samples using ASTM Type I Reagent. Table 2-3 summarizes the field and rinsate blank samples that were collected and submitted for analysis.

No field blank was collected on the initial sampling day (6/17/19) when NP were collected from the LOL reach. However, when the field team returned to this reach on 6/19/19 to collect RB, a field blank sample was collected.

3.1.5 Evaluation of Field Sampling Deviations

Field sampling deviations commonly occur within site sampling programs. Overall, EPA does not consider any of the described field sampling deviations above to impact data usability of the 2019 fish tissue data. The implications of these deviations for data usability in the risk assessments are discussed below.

3.1.5.1 Deviations in Fish Sample Numbers

As noted in EPA (2019a), the primary study goal was to address risk-related questions associated with the consumption of fish tissues, specifically:

Will the health of recreational anglers or subsistence harvesters be adversely affected when they consume fish caught from the CFR?

Will growth, reproduction, or survival of aquatic-associated wildlife be adversely affected by consuming higher tropic-level fish caught from the CFR?

For the site risk assessments, fish tissue data for the FRN reach located adjacent to and just downstream of the site are needed to evaluate these questions in the context of risk characterization. Target goals based on fish numbers were achieved for the FRN reach (20 RB, 20 NP).

Evaluation within the risk assessments of incremental risks that account for potential background contributions of contamination in fish tissues requires an understanding of risks associated with consuming fish collected from upstream reaches. Target goals based on fish numbers for RB were achieved at multiple upstream reaches including COG, MIS and LOL. Target goals based

on fish numbers at the upstream reaches for NP were only achieved at LOL. Although NP data are missing for the COG and MIS reaches between the site and the confluence with the Bitterroot River, the data for LOL remain relevant for the purposes of evaluating incremental risks based on comparisons between site-impacted and upstream concentrations. Any comparisons on this basis within the risk assessments will have to consider that information from the COG and MIS reaches that may help to inform additional influences by upstream urban development are missing for NP.

Secondary questions related to nature and extent of contamination or site characterization specific to site attribution require additional data from downstream and upstream locations, respectively. Target goals based on fish numbers at the STR reach (downstream) were achieved for RB, but not NP. The lack of NP collected from the STR, COG and MIS reaches and the lack of any fish collected from the CLN and GRE reaches will limit the ability to use these data within the Remedial Investigation (RI) for purposes of further characterizing nature and extent or source attribution. Although the fish tissue data collected during the 2019 sampling event may add to the evaluation of nature and extent and source attribution within the RI, such an evaluation based on contaminant concentrations in fish tissue alone is considered highly uncertain by EPA based on the multiple variables that may impact contaminant uptake and variability across locations (e.g., fish movement, diet, age, and metabolism, sediment disturbance, bioavailability, etc).

3.1.5.2 Deviations in Fish Sizes

The fish collected in June 2019 represent the sizes of fish that would be caught by fishers (both human and ecological). In general, contaminant levels in fish tissues often depend on age, particularly for contaminants that can bioaccumulate (e.g., dioxin) where concentrations usually tend to increase with fish age. Fish size can be used as a surrogate for the age of fish (EPA 2000). It is anticipated that larger fish will have higher levels of contaminants in their tissues because they have had a longer exposure (i.e. lived longer and thus bioaccumulated more). Per EPA (2019a), the sampling goal was to collect fish of roughly equal length and size at each of the sampling reaches to allow for a comparison of data between reaches. To meet this goal, the field teams selected individual fish within a composite such that the smallest individual included in the composite was within 75% of the length of the largest fish included in the composite. This was achieved for all composite samples.

3.1.5.3 Deviations in Field Processing

The live cart was mesh and at some stations where the shore was not a rocky bottom, fish movement disturbed underlying sediment. However, there are no data to confirm the assumption

made by commenters that these sediments contained elevated concentrations of dioxins. Additionally, fish were rinsed prior to field processing and rinsed again prior to laboratory processing.

HGL did euthanize some of the fish with a sharp blow to the back of the head, but this was only done on a few larger specimens collected at the beginning of the sampling period. Instead, HGL typically measured the fish while holding it tightly, wrapped it in foil and put it on ice. After being in the live well and then the live cart for a fair amount of time, most fish were fairly sedate. Fish that were dropped in the field were rinsed consistent with EPA (2019a) thus limiting the influence of potential contamination on the skin surface resulting from being dropped.

The truck driven by the HGL field team was backed up to the river at the location where the fish transfers occurred mostly blocking the boat ramp and limiting additional vehicle traffic. None of the EPA field team noted dusty conditions at the shore during the field transfer and on one day rain limited dust production. Fish measurements done on the tailgate or cooler were consistently done on top of clean foil as specified in EPA (2019a).

3.1.5.4 Deviations in Field QC Samples

The absence of a field blank on the first day of sampling and a wipe blank on the first day of sampling will be considered during data evaluation, but EPA does not consider this a significant concern based on the other available blank data.

3.2 Fish Processing Deviations

After collection of fish by MFWP and transfer to HGL, fish samples were driven in coolers to an offsite laboratory facility to be filleted and packaged for shipment to the ESAT laboratory. Laboratories by nature are more controlled environments than outdoor sampling areas; as such, deviations from the SAP/QAPP are expected to be less in this portion of the field program. Noted deviations are described below.

3.2.1 Oversight

At the field processing facility in Superior, MT (typically a 1-hour drive from sample transfer locations), an SRC representative provided oversight of the HGL processing team. In addition, a PRP representative was also present to provide oversight duties. Fish were all processed within the 48-hour window specified in the SAP/QAPP between sample collection time and resection time. At no point did the PRP representative question or comment on the fish processing directly to the field processing staff or SRC. Comments received after completion of the sampling event

noted that decontamination procedures observed in the fish processing lab facility were generally consistent with those described in the 2019 SAP except that laboratory grade detergent was not used.

3.2.2 Fish Resection Processing Deviations

Table 3-1 summarizes the notes included on the fish processing forms of instances of abrasions/injuries noted on fish specimens, instances where internal organs were accidentally punctured/nicked during filleting, and other notable observations. In all instances where internal organs were punctured or nicked, fillets were rinsed consistent with EPA (2019a). One fillet was accidentally dropped in the bucket used to collect rinsate; it was removed immediately and rinsed with distilled water and ASTM water prior to additional processing.

3.2.3 Field Processing QC Samples

Per EPA (2019a), one processing rinsate per 20 fish should have been collected in amber glass jars as 1 L samples. Periodic wipe samples of the clean areas used for processing should have also been collected. The SAP/QAPP did not specify how often to collect wipe samples, but EPA requested that two wipe samples be collected at the beginning of fish processing (following set-up and cleaning), one wipe sample be collected during the sampling event, and one wipe sample be collected at the end of the sampling event. Processing at the Superior facility began on 6/18/19, but the filter pads used to collect the wipe samples were accidentally left at the hotel by HGL. Due to the distance between the processing facility and the hotel and the time required to make the round-trip, it was decided not to hold up processing at that point. Two wipe samples were collected following the initial cleaning of the processing areas the next day (6/19/19).

3.2.4 Fish Shipment Deviations

Fish samples were maintained in the freezer at the processing lab prior to shipment to ensure that tissues were frozen prior to shipment. Tissue samples were not transferred to coolers for shipment until they were confirmed to feel frozen (i.e. solid) by the field processing team. Samples were shipped in coolers with dry ice via FedEx overnight delivery. Coolers containing the NP collected from the LOL reach on 6/17/19 (processed on 6/18/19-6/19/19) were sent via FedEx on 6/20/19. This shipment was delayed due to issues with the FedEx plane and was diverted through Memphis, TN on 6/21/19. EPA contacted FedEx and asked that they hold the coolers in their cooler overnight. Samples were shipped from Memphis to Denver on 6/22/19 and received by ESAT (Mike Carney). M. Carney confirmed samples arrived frozen solid with dry ice remaining. All other tissue samples were shipped via overnight delivery by FedEx on 6/24/19 and received by ESAT in the morning on 6/25/19. Three coolers of QC samples were also

shipped with wet ice on 6/24/19. ESAT confirmed that all fish were frozen upon receipt, and blank samples were chilled to <6°C. However, it was noted that the tape was cut on one of the coolers containing the blank samples.

3.2.5 *Evaluation of Field Processing Deviations*

3.2.5.1 Fish Resection Processing Deviations

At the field processing facility, fish were resected in accordance with EPA (2019a). Based on the information provided to EPA, instances where processing deviations occurred were addressed appropriately by rinsing the fillet tissues in accordance with EPA (2019a). However, the evaluation of the fish tissue data in the risk assessments will take this information into consideration if concentrations associated with these samples appear significantly different from the other composite samples for that tissue type and location. The uncertainty assessments within the risk assessments will include discussion of these issues if relevant.

3.2.5.2 Fish Shipment Deviations

Given that ESAT confirmed that all fish samples remained frozen upon receipt, EPA does not consider the delayed delivery of the initial pike samples to represent a significant concern.

4.0 2019 LABORATORY SAMPLE PROCESSING DEVIATIONS

Deviations noted by ESAT that occurred during the sample processing conducted in December 2019 which involved grinding the fish samples to create the composite samples consistent with the fish tissue processing Standard Operating Procedure (SOP) included in Appendix B of EPA (2019a) are, as follows:

- The fish tissue processing SOP specifies that both fillets and remainders (carcasses) will be homogenized by the meat grinder. Before proceeding with processing of investigative samples, ESAT performed trial runs on whole rainbow trout purchased from a local grocery store. ESAT determined that an unacceptable loss of sample mass occurred when small rainbows were homogenized by the grinder. Small amounts of tissue remain in the grinder after processing, which leaves less tissue mass available for the homogenates. As such, for both the 2018 and 2019 processing activities, ESAT used the meat grinder only for homogenization of all large remainders (those greater than approximately 12" in length) and all large fillets (those greater than approximately 500 grams in weight). Smaller remainders and fillets were homogenized by first cutting them into quarter-inch cubes with stainless steel knives and/or scissors followed by homogenization in a blender.

- The fish processing SOP indicates that all organisms in a composite sample should be of the same species. At least one cutbow (rainbow-cutthroat hybrid) was collected by the field team at the COG segment of the CFR. Fish COG-RB-02-C1 from the 2019 sampling event was determined by the processing team to be a cutbow whereas the other four COG-RB-C1 fish were rainbows. It is possible that other cutbows were collected but identified as rainbows.

EPA does not consider the use of a blender for smaller remainders and fillets as a significant deviation that impacts data usability. The potential for cutbow specimens to be included in the RB samples will be noted, but given that fish were of acceptable length for compositing and given that there is no information available to suggest that a cutbow specimen caught by a recreational fisher or tribal harvester would not be consumed for not being a RB, inclusion of this fish in the 2019 samples is not expected to significantly impact data usability for risk assessment purposes.

5.0 2019 SAMPLE ANALYSIS AND DATA VALIDATION

5.1 Summary of ALS Analysis and Weston Validation

Samples were submitted to ALS Environmental (ALS). The analysis of D/Fs, % moisture, and % lipids was done at the Houston laboratory (five sample delivery groups [SDGs]). The analysis of PCBs was done at the Burlington laboratory (five SDGs). Analytical results for D/Fs were reported in the laboratory reports and electronic data deliverables (EDDs) on a dry weight (dw) basis. Analytical results for PCBs were reported in the laboratory reports and EDDs on a wet weight (ww) basis. Method blank results were reported as appropriate. ALS confirmed that all samples were received in good condition and were consistent with the accompanying COC form. The samples were stored in a freezer at -20°C upon receipt at the laboratory.

Of note, based on review of the unvalidated analytical results, one sample (SR-2001-46) was flagged for re-evaluation by EPA based on reported concentrations observably elevated when compared to the other composite samples for the same location. An additional SDG was created for this sample. A case narrative for this sample is posted on the Superfund website for the Smurfit-Stone/Frenchtown Mill Site. In brief, neither the reanalysis of the sample on 3/26/20, nor the matrix spike (MS) or matrix spike duplicate (MSD) analyses on 1/23/20 confirmed the high-level detections reported in the original analysis. The concentration based on the re-analysis is considered representative of the measured concentration for this sample.

Laboratory reports were provided to Weston Solutions (Weston) for third party data validation. Weston contracted the services of MEC^x which produced a data validation report for each SDG. Upon review of the validation report files (inclusive of the validation reports, validated EDDs, and TEQ calculation spreadsheets) provided to EPA by MEC^x, several data questions and issues

were identified by EPA for follow-up by either ALS or MEC^x as summarized in Attachment 1. The corrected analytical laboratory reports and data validation reports have been posted on the Site website. Details related to the analysis of the tissue samples, field and processing QC samples, and laboratory QC samples can be found in these reports. The following sections highlight items flagged by the validators.

5.2 Detectable Contaminant Levels in Laboratory Blanks

5.2.1 Detectable Levels of PCBs in Method Blanks

The validation reports included discussion of qualifications based on method blanks in each SDG with samples analyzed for PCBs. The validation reports consistently noted numerous target PCB detects above the estimated detection limits (EDLs) in the laboratory method blanks across all SDGs for samples analyzed for PCBs. Many sample detects above the reporting limit (RL) for the method blank contaminants exceeded five-times (5x) the method blank concentrations and required no qualification. Method blank contaminants requiring qualification of associated samples were those sample detects less than (<) 5x the method blank concentrations; these results were qualified as nondetects with a “U” qualifier at the level of contamination.

5.2.2 Detectable Levels of D/Fs in Method Blanks

The validation reports included discussion of qualifications based on method blanks in each SDG with samples analyzed for D/Fs. Per National Functional Guidelines (NFG) and based on professional judgment, the validators qualified sample results detected below the RL for the isomer method blank contaminants and near or less than 5x the method blank concentrations (10x for OCDD and OCDF) as nondetects (flagged with a “U” qualifier) at the level of contamination. Detected sample concentrations below the RL but significantly greater than 5x the method blank concentrations were qualified as estimated with a potential positive bias (flagged with a “J+” qualifier).

5.3 Qualification of Analytical Results based on Field QC Data

5.3.1 Detectable Levels of PCBs in Field QC samples

Field rinsate blanks, field processing rinsates, and wipe samples were reported to have detectable levels of PCB congeners. A bottle/reagent blank sample also had detectable levels of some PCB congeners, as did equipment blanks prepared by ESAT. Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Remaining detects were used to evaluate the associated site samples. Site sample detects below the RLs for the field QC contaminants were qualified as estimated with a potential positive bias (flagged with a “J+” qualifier).

5.3.2 Detectable Levels of D/Fs in Field QC samples

Field blanks, rinsate blanks, processing rinsates, and wipes included reportable D/F isomer detects. A bottle/reagent blank sample had a reportable level of one D/F isomer also. In the absence of conflicting bias, site samples included in SDGs E1900932 and E1900931 below the RLs for the field QC contaminants were qualified as estimated with a potential positive bias (flagged with a “J+” qualifier).

5.4 Estimated Maximum Possible Concentrations (EMPCs)

When the ion abundance ratios associated with a particular compound are outside the QC limits, samples were flagged to indicate an estimated maximum possible concentration (EMPC) for the associated compound. For PCB results, if the concentration of a reported EMPC was below the EDL, the result was reported by the laboratory as a nondetect (flagged with “U” qualifier) at the EDL. If the EMPC concentration was between the EDL and the RL, the result was reported as a nondetect (flagged with “U” qualifier) by the laboratory and the EDL raised to the level of the EMPC. Those EMPC results not previously qualified as nondetects for method blank contamination were qualified by the validators as estimated nondetects (flagged with a “UJ” qualifier). For D/F results, isomers previously qualified as nondetects for method blank contamination were not further qualified as EMPCs. Remaining isomers reported as EMPCs were qualified as estimated nondetects (flagged with a “UJ” qualifier) at the level of the EMPC.

5.5 Rejected Data

Three D/F congener results were qualified rejected “R” by the validators in sample SR-2001-48 (octachlorodibenzo-*p*-dioxin [OCDD], octachlorodibenzofuran [OCDF] and 1,2,3,4,7,8,9-heptachlorodibenzofuran [HpCDF]). The other congener data remain valid and will be used when evaluating this sample.

6.0 DATA SUMMARY

The data on PCBs and D/Fs in the 2019 fish tissues will be used in the risk assessments for the Smurfit-Stone/Frenchtown Mill Site. Total PCBs and toxicity equivalent (TEQ) concentrations for D/Fs were calculated by the analytical laboratory and the validators and included in the respective reports. For the risk assessments, total PCB concentrations will be calculated as the sum across PCB congeners for each sample. Co-eluted congeners were reported as a single result (e.g., PCB 138/163/129); thus a single result for co-eluted congeners will be included in the total PCB sum. TEQ concentrations based on D/Fs and based on dioxins/furans/co-planar PCBs (D/F/Ps) will be calculated using available mammalian, avian and fish toxicity equivalence factors (TEFs) as follows:

$$TEQ = \Sigma (C_i \times TEF_i)$$

Risks from exposures to Total PCBs and TEQ in fish tissues will be evaluated in the risk assessments based on evaluating nondetects at ½ the sample-specific detection limits (DLs). PCB and D/F congener results that were reported as detected by ALS but qualified as nondetects by the validators (flagged with a “U” or “UJ” qualifier) will be assessed at ½ the sample result. Additional calculations based on evaluating nondetects at zero will be included in the risk assessments to support evaluations of uncertainties in the risk estimates.

Fish tissues evaluated for PCBs and D/Fs included fillets (skin on and belly flap attached) and remainder portions. Because the risk assessments will include evaluation of exposures to wildlife consuming the whole fish and exposures to subsistence fishers who may consume additional organs or use other fish parts to make soups/stews (e.g., fish heads), estimated whole body concentrations will be calculated, as follows:

$$C_{wb} = \frac{(C_f \times W_f + C_c \times W_c)}{(W_f + W_c)}$$

where:

C_{wb}	=	whole-body concentration (pg/g)
C_f	=	fillet concentration (pg/g)
C_c	=	carcass concentration (pg/g)
W_f	=	weight of the fillet (g)
W_c	=	weight of the carcass (g)

6.1 2019 Fish Tissue Results

6.1.1 Fish Tissue PCB Results

Table 6-1 summarizes the total PCB concentrations for the 2019 fish samples. Values in this table are presented on a dry weight (dw) basis; % moisture and % lipid results are also presented. These results can be used to calculate total PCB concentrations on a wet weight basis or on a lipid-adjusted basis.

6.1.2 2019 Fish Tissue Dioxins, Furans, and Dioxin-like PCB Results

Table 6-2 presents the TEFs for mammals birds, and fish. The mammalian TEFs will be used to evaluate exposures to human health receptors in the risk assessments consistent with EPA guidance (EPA 2010). The mammalian, bird, and fish TEFs will be used to evaluate exposures to ecological receptors in the baseline ecological risk assessment (BERA). Table 6-3 summarizes the mammalian TEQ concentrations for the 2019 fish samples. Values in this table are presented

on a dry weight (dw) basis; % moisture and % lipid results are also presented. These results can be used to calculate TEQ concentrations on a wet weight basis or on a lipid-adjusted basis.

6.2 2018 Fish Tissue Results

6.2.1 Summary of 2018 Fish Tissue Laboratory Deviations

Prior to the analysis of the fish collected by MFWP and EPA in 2018, EPA issued a technical memorandum summarizing field sampling deviations associated with that event (EPA 2019b). In 2018 RB were collected from all reaches sampled, including the upstream reaches at CLN and GRE. Only 4 RB were collected from COG, 8 RB were collected from GRE, and 19 RB were collected from MIS; 20 RB were collected from all other reaches. In 2018, RB were collected from the Bitterroot River at Florence (FLO), a location upstream from LOL. Several RB that were collected in 2018 were below the target size range of 250-350 mm (1 RB from MIS, 1 RB from CLN, and 5 RB from GRE). In 2018, 20 NP were collected from each of the FRN and LOL reaches. One NP was also collected from each the COG and the MIS reaches. Five of the NP collected from the FRN reach, and 8 of the NP collected from the LOL reach measured <500 mm.

As noted in EPA (2019b), COC forms were not submitted with the fish tissue samples when transferred from MFWP to ESAT and no adequate field blank samples were collected. However, EPA committed to analyzing the 2018 fish samples consistent with EPA (2019a). On this basis, the 2018 fish samples were processed by ESAT in May/June 2019. Deviations noted by ESAT during sample processing of the samples associated with the fish collected in 2018 were as follows:

- Carcass sample LOL-NP-FCT-01b, collected on 7/2/2018, was accidentally dropped on the floor during processing on 5/29/19. The fish was a large pike that required a saw to cut through the bones, with one person holding the fish on the table with forks while another person sawed. One of the forks slid loose and the action of the saw caused the fish to fall on the laboratory floor, which was made of resilient vinyl sheeting. The fish was washed with de-ionized water before processing continued, which was completed without further incident.
- The fish tissue processing SOP specifies that both fillets and remainders (carcasses) will be homogenized by the meat grinder. Before proceeding with processing of investigative samples, ESAT performed trial runs on whole rainbow trout purchased from a local grocery store. ESAT determined that an unacceptable loss of sample mass occurred when small rainbows were homogenized by the grinder. Small amounts of tissue remain in the grinder after processing, which leaves less tissue mass available for the homogenates. As such, for both the 2018 and 2019 processing activities, ESAT used the meat grinder only for homogenization of all large remainders (those greater than approximately 12" in

length) and all large fillets (those greater than approximately 500 grams in weight). Smaller remainders and fillets were homogenized by first cutting them into quarter-inch cubes with stainless steel knives and/or scissors followed by homogenization in a blender.

- The fish processing SOP specifies a minimum mass of 200 grams for the composite homogenate (i.e. the final tissue after processing that is split into aliquots for the jars submitted to the analytical laboratory). Fillets of smaller fish were not always massive enough to yield this minimum sample weight, and mass loss during processing contributed to the problem. For the 2018 sampling event, composite homogenates for the fillets were less than 200 grams for the smallest northern pike and approximately two-thirds of the rainbow trout.

Similar to the 2019 samples, the validators noted detectable levels of PCB congeners above the EDL in method blanks as well as detectable D/F congeners in method blanks, both of which resulted in qualification of the 2018 sample results. However, there were no field QC samples available for the 2018 SDGs, thus qualification on this basis could not be conducted. Based on the 2019 results, it is expected that had field QC samples been available, the 2018 results would have been qualified on a similar basis to the 2019 results (i.e., site sample detects below the RLs for the field QC contaminants qualified as estimated with a potential positive bias).

The reported % lipids for samples 47723-22, 47723-49, and 47723-86 were above 100%. ALS confirmed that due to an error in not allowing all of the solvent to fully evaporate prior to analysis, these values are invalid.

6.2.2 2018 Fish Tissue PCB and D/F Results

Table 6-4 summarizes the total PCB concentrations for the 2018 fish samples. Table 6-5 summarizes the TEQ concentrations for the 2018 fish samples.

6.3 Comparison of 2018 and 2019 Fish Tissue Data

6.3.1 Comparison of 2018 and 2019 Fish

Table 6-6 summarizes the fish collected in 2018 and 2019 at each sampling location by length and weight. Notable differences between 2018 and 2019 included the following:

- Several upstream locations (Clinton and Greenough) sampled in 2018 were not sampled in 2019 as described in the sampling deviations section above.
- Only four rainbow trout were collected from the Council Grove reach in 2018, compared to 20 collected from this reach in 2019.

- Northern pike collected in 2019 were generally larger than pike collected in 2018.

6.3.2 Comparison of 2018 and 2019 Fish Tissue Sample Detection Limits

Figure 6-1 and 6-2 plot the detection limits (in wet weight) for the 2018 and 2019 fish samples for PCBs and dioxins/furans, respectively. The observed variability in the reported sample-specific detection limits shown in these figures is not necessarily unexpected for biological tissues.

6.3.3 Comparison of 2018 and 2019 Fish Tissue Sample Concentrations

Table 6-7 presents the TEQ and total PCB concentrations (in wet weight) for the 2018 and 2019 fish samples by sampling location. The FRN reach represents the reach directly adjacent to and immediately downstream of the Site. As shown in Table 6-7, TEQ concentrations based on dioxins/furans are generally similar between the two years. Also, total PCB concentrations in fish collected from this reach were generally comparable between the two years, but TEQ concentrations calculated for dioxin-like PCB congeners is notably elevated in one of the RB samples based on fish collected from this reach in 2019. The concentration in this sample is generally similar to three of the four RB samples based on fish collected from the farthest downstream reach (STR) in 2019.

7.0 FISH TISSUE DATA USABILITY IN SUPERFUND RISK ASSESSMENT

EPA has determined that the 2019 fish tissue data meet data quality criteria goals and are considered usable in the Site risk assessments. EPA intends to utilize the 2019 fish tissue data in the quantitative risk estimates and will include a qualitative discussion of the associated uncertainties. Furthermore, evaluations based on the 2019 data will need to consider the data limitations when evaluating background contributions to incremental risk estimates based on missing data (i.e., no fish data collected from CLN and GRE).

The 2019 sampling effort was carried out, in part, due to data usability concerns with the 2018 fish sampling effort. As noted in EPA (2019b), these concerns included the lack of COC forms submitted with the 2018 fish tissue samples shipped to the ESAT laboratory, and a lack of QC field samples. The lack of the COC forms limits the Agency's ability to confirm the integrity of the fish tissue samples (during transmittal to and upon receipt at ESAT) and the accuracy of sample identification numbers, collection times, etc. in the context of Superfund policies. Similarly, the lack of reliable field QC samples limits the EPA's ability to verify that contamination of samples and/or cross-contamination between samples did not occur. Under the Superfund requirements to meet data quality, the 2018 fish cannot be quantitatively used as the basis of decision-making. EPA does not consider the data criteria limitations of the 2018 fish to significantly impact the concentrations of contaminants within the fish tissues themselves, so

EPA will also evaluate the 2018 and 2019 data combined within the qualitative uncertainty assessments of the OU3 HHRA and the BERA. This approach will allow for presentation of risk estimates based on the 2019 fish tissue concentrations that are generally higher when based on an upper bound estimate of the mean for potential site exposures than the 2018 fish tissue concentrations which represents a health-protective (more conservative) approach, while at the same time provide risk managers with more information to understand potential uncertainties associated with those risk estimates. In order to use the 2018 data in this manner, the concentration data associated with the 2018 samples will be qualified to flag the uncertainties associated with data usability under Superfund policies.

8.0 REFERENCES

EPA. 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. Prepared by U.S. Environmental Protection Agency. EPA/100/R10/005. December.

EPA. 2018a. Draft Human Health Risk Assessment for the Smurfit-Stone/Frenchtown Mill Operable Unit 3 Site Located in Missoula County, Montana. External Review Draft. February.

EPA. 2018b. Sampling and Analysis Plan/Quality Assurance Project Plan: 2018 Fish Tissue Study. Smurfit-Stone/Frenchtown Mill Site, Missoula County, Montana. Revision 0. Prepared by U.S. Environmental Protection Agency, Region 8. June.

EPA. 2019a. Sampling and Analysis Plan/Quality Assurance Project Plan: 2019 Fish Tissue Study. Smurfit-Stone/Frenchtown Mill Site, Missoula County, Montana. Revision 0. Prepared by U.S. Environmental Protection Agency, Region 8. May.

EPA. 2019b. Final Technical Memorandum Summary of the July 2018 Game Fish Sampling. Prepared by U.S. Environmental Protection Agency, Region 8. April.

ATTACHMENT 1
Summary of Data Issues and Resolutions

Data Issue Identified	Resolution
<p>The original PCB TEQ calculation files provided to EPA by the validator (MEC^x) included errors in the TEF values entered for PCB169 and PCB 189 in the <i>2018_PCB_TEF_Calcs.xlsx</i> file and an incorrect formula used for results in the <i>2019_PCB_TEF_Calcs.xlsx</i> file where the qualifier was entered as *III.</p>	<p>The validator reviewed the identified errors and incorporated corrections as appropriate. Revised validation reports, EDDs, and PCB TEQ calculation files were provided to EPA.</p>
<p>The original <i>2019_Smurfit_Dioxins_TEQs_Calcs.xlsx</i> file provided to EPA by the validator included an error in the calculation lookup formula for ten samples.</p>	<p>The validator reviewed the identified calculation error and incorporated corrections as appropriate. A revised validation report, EDD, and TEQ calculation file (<i>2019_Smurfit_Dioxins_TEQs_calcs_revised06022020.xlsx</i>) were provided to EPA.</p>
<p>The validator identified the 2018 sample 47723-91 incorrectly as a field duplicate for sample 47723-90. Sample 47723-91 is identified on the COC as a field sample and per the ESAT bench sheet this sample ID corresponds to the carcass sample for the NP specimen collected from the Missoula reach (sample 47723-90 is the fillet sample for this specimen).</p>	<p>MEC^x had to re-validate these samples based on this clarification. Revised validation reports and EDDs were provided to EPA.</p>
<p>There was no “Sample Type” field included in the 2018 COC sent from ESAT to ALS for SDG E1900440. Therefore, the validator did not have the information necessary to identify the following samples as processing duplicate samples: 47723-83 (parent sample 47723-14), 47723-82 (parent sample 47723-16), 47723-81 (parent sample 47723-65), 47723-80 (parent sample 47723-70).</p>	

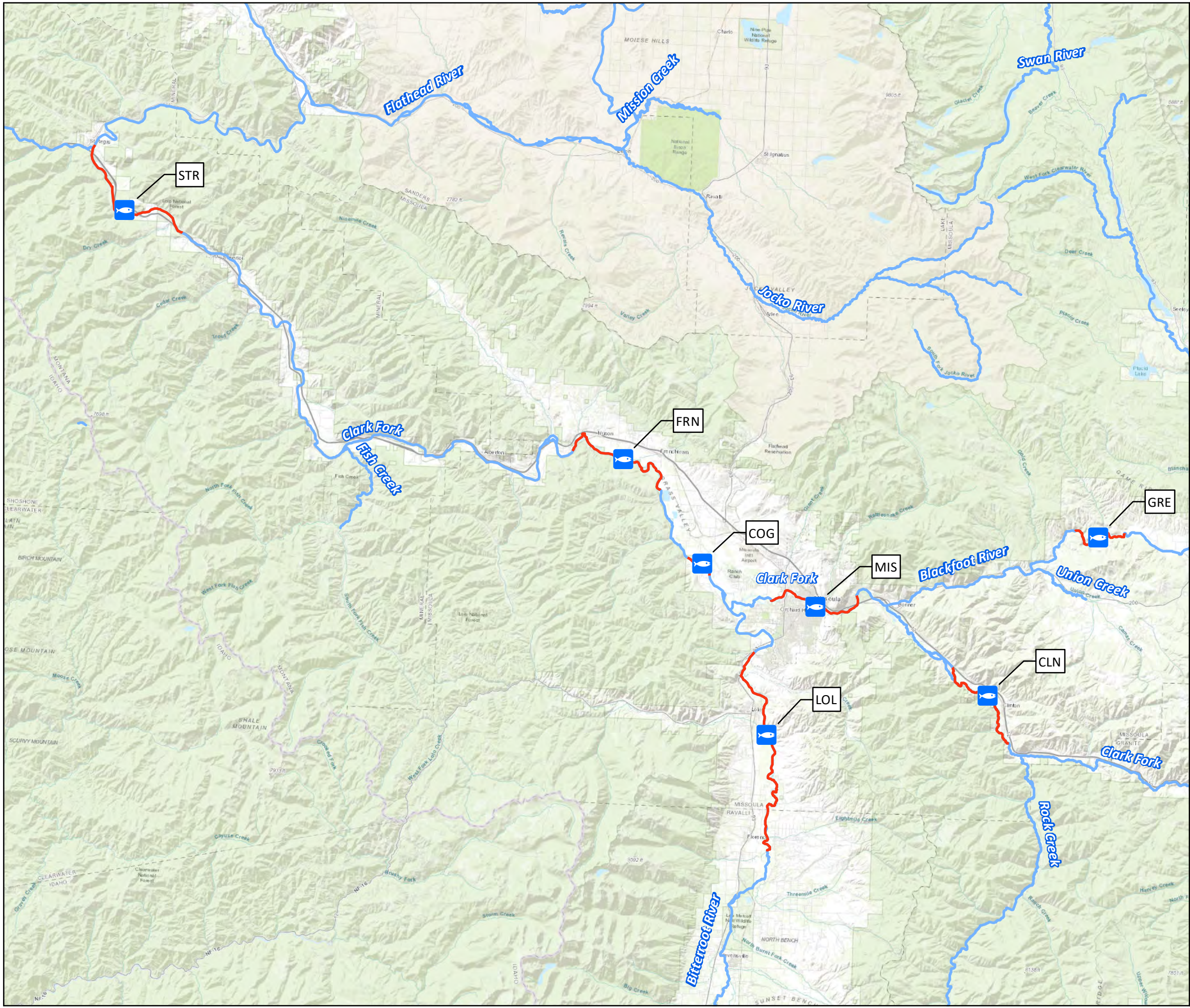
ATTACHMENT 1
Summary of Data Issues and Resolutions


Data Issue Identified	Resolution
Samples 47723-100 through 47723-110 (SDG E1900480/L2299905) were listed on the ESAT COC sent to the analytical laboratory (ALS) as “lab blank”, but no other information was available. ESAT forwarded a COC to EPA on Monday (7/8/20) that indicated that these were bottle blank and rinsate blank samples.	MEC ^x confirmed that the validators identified these samples as some type of field blank and used them to flag site samples as appropriate based on the collection dates. MEC ^x confirmed that no change was necessary based on the additional clarification of blank type provided by EPA.
Three percentage lipid results from 2018 were reported at levels greater than 100% (sample IDs 47723-22, 47723-49, and 47723-86).	ALS confirmed that the lipids determination for these three samples was incorrectly reported. The extraction analyst did not ensure that the solvent evaporated to dryness during the final step of the lipid content determination. Due to this error, the percent lipid results reported above 100% are not valid. ALS issued a revised analytical report and EDD for SDG E1900479. The invalid lipid results were removed from both.
The percentage lipid was reported as “ND” for the 2108 sample 47723-38.	Follow-up with ALS determined that the “ND” was entered incorrectly when reading data from the bench sheets into the electronic file. The correct lipid percentage for this sample is 37.6%. ALS submitted a revised laboratory report (SDG E1900479) and EDD with the corrected value to EPA.

ATTACHMENT 1
Summary of Data Issues and Resolutions

Data Issue Identified	Resolution
<p>The original analytical report for the 2018 samples analyzed by the Burlington ALS laboratory for PCB congeners submitted to EPA included multiple data packages. Each data package included a “Section 1 Case Narrative” where the basis of the reported results was stated (e.g., dry weight basis). All but two of the 2018 data packages explicitly stated in the Section 1 Case Narrative that results were reported on a dry weight basis. The Section 1 Case Narrative for the data package for SDG E1900479/L2299834 (Part 3) indicated that results were reported on an “as is wet basis”. The Section 1 Case Narrative for the data package for SDG E1900440/L2295597 did not specify the basis of the reported results for the sub-package that included lab samples L2295597-15 through L2295597-34.</p>	<p>ALS reviewed the data packages submitted to EPA and confirmed that all results reported for the 2018 samples were reported on a dry weight basis. ALS submitted revised laboratory reports reflecting this correction for SDGs E1900479/L2299834 and E1900440/L2295597 to EPA.</p>

Figure 2-1
Spatial Boundary for Fish Sampling
Locations (2019)



 Fish (Northern Pike and Rainbow Trout)
Sampling Locations

 Reaches

 Rivers

Map Date: April 5, 2019

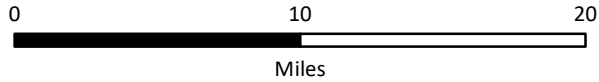
Data Sources:

Sample Locations: U.S. EPA (2019).

Rivers and Reaches: U.S. EPA and NHD Plus (2012).

Imagery: ESRI World Topo Service (2019).

Map Projection: UTM Zone 12N, WGS84, Meters



Area of Interest

Figure 6-1. Detection Limits of PCB Congeners in 2018 and 2019 Fish Tissue Samples

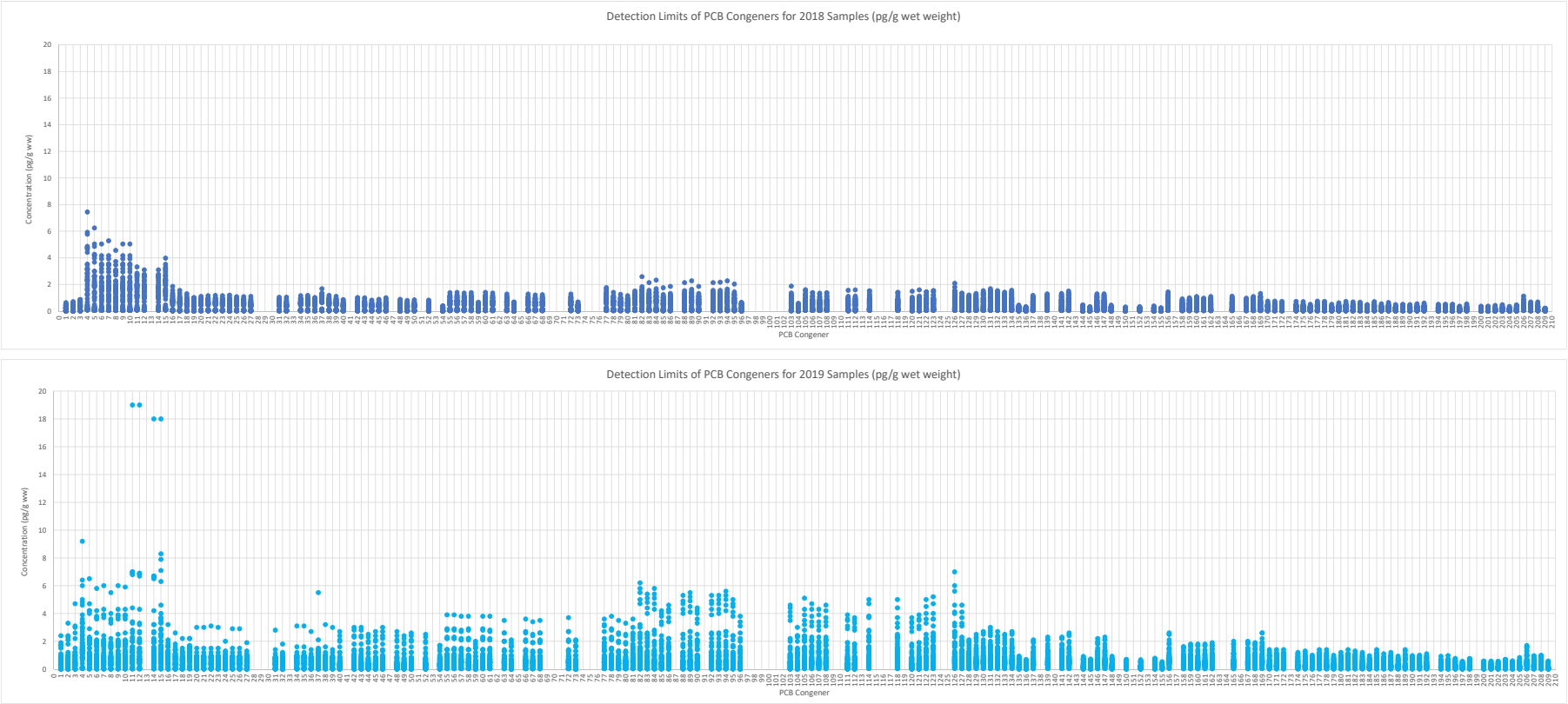


Figure 6-2. Detection Limits of Dioxin/Furan Congeners in 2018 and 2019 Fish Tissue Samples

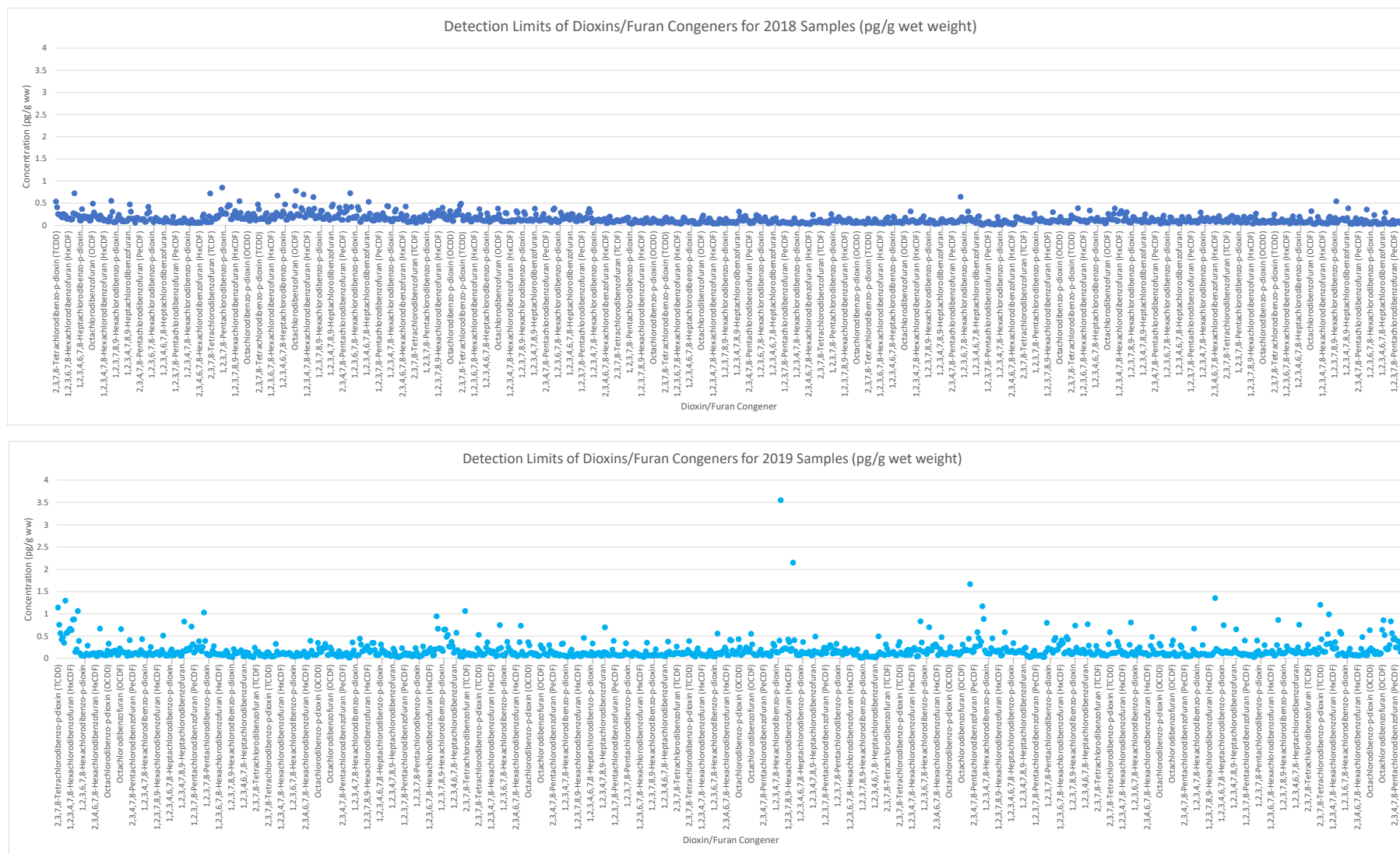


Table 2-1. Fish Collected in 2019

Fish Species	River	Sampling Station	Target Number of Fish to Collect	Number of Fish Collected	Target Fish Length (mm)	Size Range of Fish Collected (mm)	Composite 1				Composite 2				Composite 3				Composite 4			
							N Fish	Min of Min Length (mm)	Max of Max Length (mm)	Ratio Min/Max	N Fish	Min of Min Length (mm)	Max of Max Length (mm)	Ratio Min/Max	N Fish	Min of Min Length (mm)	Max of Max Length (mm)	Ratio Min/Max	N Fish	Min of Min Length (mm)	Max of Max Length (mm)	Ratio Min/Max
Rainbow Trout (RB)	Clark Fork River	St. Regis	20	20	250-350	280-428	5	390	428	91%	5	356	386	92%	5	350	360	97%	5	280	344	81%
		Frenchtown	20	20	250-350	272-450	5	398	450	88%	5	350	372	94%	5	310	348	89%	5	272	304	89%
		Council Grove	20	20	250-350	258-432	5	410	432	95%	5	374	406	92%	5	310	360	86%	5	258	284	91%
		Missoula	20	20	250-350	264-450	5	360	450	80%	5	350	372	94%	5	294	350	84%	5	264	294	90%
		Clinton	20	0	250-350	n/a	0	n/a			0	n/a			0	n/a			0	n/a		
	Bitterroot River	Lolo	20	20	250-350	255-430	5	380	430	88%	5	355	400	89%	5	300	355	85%	5	255	300	85%
	Blackfoot River	Greenough	20	0	250-350	n/a	0	n/a			0	n/a			0	n/a			0	n/a		
Northern Pike (NP)	Clark Fork River	St. Regis	20	0	500-760+	n/a	0	n/a			0	n/a			0	n/a			0	n/a		
		Frenchtown	20	20	500-760+	550-1020	5	780	1020	76%	5	750	764	98%	5	600	714	84%	5	550	590	93%
		Council Grove	20	1	500-760+	720	1	720	720	100%	0	n/a			0	n/a			0	n/a		
		Missoula	20	0	500-760+	n/a	0	n/a			0	n/a			0	n/a			0	n/a		
		Clinton	20	0	500-760+	n/a	0	n/a			0	n/a			0	n/a			0	n/a		
	Bitterroot River	Lolo	20	20	500-760+	470-930	5	750	930	81%	5	630	710	89%	5	560	630	89%	5	470	560	84%
	Blackfoot River	Greenough	20	0	500-760+	n/a	0	n/a			0	n/a			0	n/a			0	n/a		

n/a = not applicable (no fish collected).

Table 2-2. Summary of 2019 Fish Homogenate Field Samples

Species	Sampling Location (Reach)	Sample ID	Tissue Type	Dioxin/Furan SDG-Lab Sample ID	PCB SDG-Lab Sample ID
Rainbow Trout (RB)	Lolo	SR-2001-30	Fillet	E1900931-029	L2402109-29
		SR-2001-31	Carcass	E1900931-030	L2402109-30
		SR-2001-32	Fillet	E1900931-031	L2402109-31
		SR-2001-33	Carcass	E1900931-032	L2402109-32
		SR-2001-35	Fillet	E1900931-033	L2402109-33
		SR-2001-36	Carcass	E1900931-034	L2402109-34
		SR-2001-37	Fillet	E1900931-035	L2402109-35
		SR-2001-38	Carcass	E1900931-036	L2402109-36
	Missoula	SR-2001-15	Fillet	E1900931-015	L2402109-15
		SR-2001-16	Carcass	E1900931-016	L2402109-16
		SR-2001-24	Fillet	E1900931-023	L2402109-23
		SR-2001-25	Carcass	E1900931-024	L2402109-24
		SR-2001-26	Fillet	E1900931-025	L2402109-25
		SR-2001-27	Carcass	E1900931-026	L2402109-26
		SR-2001-28	Fillet	E1900931-027	L2402109-27
		SR-2001-29	Carcass	E1900931-028	L2402109-28
	Council Grove	SR-2001-39	Fillet	E1900931-037	L2402109-37
		SR-2001-40	Carcass	E1900931-038	L2402109-38
		SR-2001-41	Fillet	E1900932-001	L2402113-1
		SR-2001-42	Carcass	E1900932-002	L2402113-2
		SR-2001-45	Fillet	E1900932-004	L2402113-4
		SR-2001-46	Carcass	E2000197-001	L2402113-5
		SR-2001-47	Fillet	E1900932-006	L2402113-6
		SR-2001-48	Carcass	E1900932-007	L2402113-7
	Frenchtown	SR-2001-01	Fillet	E1900931-001	L2402109-1
		SR-2001-02	Carcass	E1900931-002	L2402109-2
		SR-2001-05	Fillet	E1900931-005	L2402109-5
		SR-2001-06	Carcass	E1900931-006	L2402109-6
		SR-2001-07	Fillet	E1900931-007	L2402109-7
		SR-2001-08	Carcass	E1900931-008	L2402109-8
		SR-2001-13	Fillet	E1900931-013	L2402109-13
		SR-2001-14	Carcass	E1900931-014	L2402109-14
	St. Regis	SR-2001-49	Fillet	E1900932-008	L2402113-8
		SR-2001-50	Carcass	E1900932-009	L2402113-9
		SR-2001-51	Fillet	E1900932-010	L2402113-10
		SR-2001-52	Carcass	E1900932-011	L2402113-11
		SR-2001-53	Fillet	E1900932-012	L2402113-12
		SR-2001-54	Carcass	E1900932-013	L2402113-13
		SR-2001-56	Fillet	E1900932-014	L2402113-14
Northern Pike (NP)	Lolo	SR-2001-57	Carcass	E1900932-015	L2402113-15
		SR-2001-58	Fillet	E1900932-016	L2402113-16
		SR-2001-59	Carcass	E1900932-017	L2402113-17
		SR-2001-61	Fillet	E1900932-019	L2402113-19
		SR-2001-62	Carcass	E1900932-020	L2402113-20
		SR-2001-64	Fillet	E1900932-021	L2402113-21
		SR-2001-65	Carcass	E1900932-022	L2402113-22
	Council Grove	SR-2001-69	Fillet	E1900932-025	L2402113-25
		SR-2001-70	Carcass	E1900932-026	L2402113-26
	Frenchtown	SR-2001-66	Fillet	E1900932-023	L2402113-23
		SR-2001-67	Carcass	E1900932-024	L2402113-24
		SR-2001-03	Fillet	E1900931-003	L2402109-3
		SR-2001-04	Carcass	E1900931-004	L2402109-4
		SR-2001-09	Fillet	E1900931-009	L2402109-9
		SR-2001-11	Carcass	E1900931-011	L2402109-11
		SR-2001-18	Fillet	E1900931-017	L2402109-17
		SR-2001-19	Carcass	E1900931-018	L2402109-18
		SR-2001-20	Fillet	E1900931-019	L2402109-19
		SR-2001-21	Carcass	E1900931-020	L2402109-20

Table 2-3. 2019 Field Quality Control Samples

Sample Type	Field ID	Sample ID	Dioxin/Furan SDG- Lab Sample ID	PCB SDG- Lab Sample ID
Field Blank	Field Blank 01	47724-589	E2000028-017	L2405997-17
	Field Blank 02	47724-590	E2000028-018	L2405997-18
	Field Blank 03	47724-591	E2000028-019	L2405997-19
	Field Blank 04	47724-592	E2000028-020	L2405997-20
	Field Blank 06	47724-594	E2000028-021	L2405997-21
Rinsate Blank	Rinsate Blank 01	47724-561	E2000028-001	L2405997-1
	Rinsate Blank 02	47724-562	E2000028-002	L2405997-2
	Rinsate Blank 03	47724-563	E2000028-003	L2405997-3
	Rinsate Blank 04	47724-564	E2000028-004	L2405997-4
	Rinsate Blank 05	47724-565	E2000028-005	L2405997-5
	Rinsate Blank 06	47724-566	E2000028-006	L2405997-6
	Rinsate Blank 07	47724-567	E2000028-007	L2405997-7
	Rinsate Blank 08	47724-568	E2000028-008	L2405997-8
Processing Rinsate	Processing Rinsate 01	47724-575	E2000028-009	L2405997-9
	Processing Rinsate 02	47724-576	E2000028-010	L2405997-10
	Processing Rinsate 03	47724-577	E2000028-011	L2405997-11
	Processing Rinsate 04	47724-578	E2000028-012	L2405997-12
	Processing Rinsate 05	47724-579	E2000028-013	L2405997-13
	Processing Rinsate 06	47724-580	E2000028-014	L2405997-14
	Processing Rinsate 07	47724-581	E2000028-015	L2405997-15
	Processing Rinsate 08	47724-582	E2000028-016	L2405997-16
Wipe	Wipe 01	47724-596	E2000028-022	L2405997-22
	Wipe 02	47724-597	E2000028-023	L2405997-23
	Wipe 03	47724-598	E2000028-024	L2405997-24
	Wipe 04	47724-599	E2000028-025	L2405997-25

PCB = Polychlorinated biphenyl; SDG = Sample Delivery Group

Table 2-4. 2019 Sample Processing Quality Control Samples

Sample Type	Sample Description	Sample ID	Dioxin/Furan SDG-Lab Sample ID	PCB SDG-Lab Sample ID
Homogenate Duplicate	Rainbow Trout from Council Grove reach; fillet sample	SR-2001-44	E1900932-003	L2402113-3
	Northern Pike from Frenchtown reach; fillet sample	SR-2001-10	E1900931-010	L2402109-10
		SR-2001-22	E1900931-021	L2402109-21
	Northern Pike from Frenchtown reach; carcass sample	SR-2001-12	E1900931-012	L2402109-12
		SR-2001-23	E1900931-022	L2402109-22
	Northern Pike from Lolo reach; carcass sample	SR-2001-60	E1900932-018	L2402113-18
Bottle Blank	Bottle Blank-01	47723-100	E1900480-001	L2299905-1
	Bottle Blank-02	47723-101	E1900480-002	
	Bottle Blank-03	47723-102	E1900480-003	L2299905-3
	Bottle Blank-04	47723-103	E1900480-004	L2299905-4
Bottle/Reagent Blank	Bottle/Reagent Blank	SR2001-55	E2000029-004	L2405988-4
Rinsate Blank	Rinsate Blank-01	47723-104	E1900480-005	L2299905-5
	Rinsate Blank-02	47723-105	E1900480-006	L2299905-6
	Rinsate Blank-03	47723-106	E1900480-007	L2299905-7
	Rinsate Blank-04	47723-107	E1900480-008	L2299905-8
	Rinsate Blank-05	47723-108	E1900480-009	L2299905-9
	Rinsate Blank-06	47723-109	E1900480-010	L2299905-10
	Rinsate Blank-07	47723-110	E1900480-011	L2299905-11
	Rinsate Blank-09	SR2001-17	E2000029-001	L2405988-1
	Rinsate Blank-10	SR2001-34	E2000029-002	L2405988-2
	Rinsate Blank-11	SR2001-43	E2000029-003	L2405988-3
	Rinsate Blank-12	SR2001-63	E2000029-005	L2405988-5
	Rinsate Blank-13	SR2001-68	E2000029-006	L2405988-6
	Rinsate Blank-14	SR2001-71	E2000029-007	L2405988-7

PCB = Polychlorinated biphenyl; SDG = Sample Delivery Group

Table 3-1. 2019 Fish Specimen Field Notes

Fish Species	Sampling Location (Reach)	Site ID	Fish ID	Field Note
Rainbow Trout (RB)	Council Grove	COG-RB	COG-RB-06	Puncture in skin on left side.
			COG-RB-11	Small abrasion on right side just under dorsal fin.
			COG-RB-04	Large piece missing from tail, ventral side.
	Frenchtown	FRN-RB	FRN-RB-19	Mild skin aberration present above dorsal fin.
	Lolo	LOL-RB	LOL-RB-05	Small abrasion on left side.
	St. Regis	STR-RB	STR-RB-10	Orange dot under throat (possible cutthroat hybrid).
Northern Pike (NP)	Frenchtown	FRN-NP	FRN-NP-01	Small abrasions on right side.
			FRN-NP-20	1 fillet accidentally dropped into the bucket used to collect rinsate, fillets rinsed after dropping with distilled and then ASTM water; internal organ nicked-fillets rinsed.
			FRN-NP-17	Had partially digested fish in gut - included with carcass; punctured intestine while processing rinsed fillet with ASTM water.
			FRN-NP-14	Small fish in stomach.
			FRN-NP-02	Injury to right gill (not gill cover, gill).
			FRN-NP-04	Small abrasion on top of head.
			FRN-NP-03	Nicked organ - internal - while filleting, fillets rinsed with ASTM Type I water.
	Lolo	LOL-NP	LOL-NP-01	Minor red splotch on left side; minor abrasion on right side. Internal organ was punctured during filleting; fillets were rinsed with ASTM Type I water.
			LOL-NP-02	One fillet dropped on floor and re-rinsed.
			LOL-NP-03	Punctured internal organ, fillets were rinsed with ASTM Type I water.
			LOL-NP-05	Small abrasion on right side.
			LOL-NP-06	Small abrasion on left side.
			LOL-NP-04	Puncture of gal bladder while filleting, fillets rinsed (per communication with field team).
			LOL-NP-20	Internal organ punctured, rinsed.
			LOL-NP-16	Mark on left side.

Table 6-1. 2019 Fish Tissue Sample Total PCB Concentrations

Fish Species	Sampling Location (Reach)	Tissue Type	Sample ID	PCB SDG-Lab Sample ID	Total PCB (pg/g-dry weight)	Percentage Solids	Percentage Lipids
Rainbow Trout (RB)	Lolo	Fillet	SR-2001-30	L2402109-29	9,792	28.9	20.4
		Fillet	SR-2001-32	L2402109-31	12,561	28.5	13.7
		Fillet	SR-2001-35	L2402109-33	9,759	29.1	20.4
		Fillet	SR-2001-37	L2402109-35	6,269	26.0	21.6
		Carcass	SR-2001-31	L2402109-30	15,545	32.1	29.4
		Carcass	SR-2001-33	L2402109-32	21,512	32.4	60.5
		Carcass	SR-2001-36	L2402109-34	11,199	36.7	53.4
		Carcass	SR-2001-38	L2402109-36	16,968	34.3	29.1
	Missoula	Fillet	SR-2001-15	L2402109-15	13,068	51.5	11.3
		Fillet	SR-2001-24	L2402109-23	37,377	30.5	38.4
		Fillet	SR-2001-26	L2402109-25	45,597	31.8	43.5
		Fillet	SR-2001-28	L2402109-27	17,939	29.6	39.6
		Carcass	SR-2001-16	L2402109-16	21,074	48.4	24.3
		Carcass	SR-2001-25	L2402109-24	86,984	31.5	35.7
		Carcass	SR-2001-27	L2402109-26	86,494	38.5	68.9
		Carcass	SR-2001-29	L2402109-28	28,457	35.0	52.8
	Council Grove	Fillet	SR-2001-39	L2402109-37	83,861	31.6	35.2
		Fillet	SR-2001-45	L2402113-4	40,437	36.6	15.6
		Fillet	SR-2001-47	L2402113-6	39,244	34.4	11.3
		Fillet	SR-2001-41	L2402113-1	69,497	31.8	18.5
		Carcass	SR-2001-40	L2402109-38	121,703	36.4	51.6
		Carcass	SR-2001-46	L2402113-5	76,500	40.0	44.7
		Carcass	SR-2001-48	L2402113-7	74,813	40.1	4.86
		Carcass	SR-2001-42	L2402113-2	57,856	54.1	35.7
	Frenchtown	Fillet	SR-2001-01	L2402109-1	50,470	31.9	22.9
		Fillet	SR-2001-07	L2402109-7	65,944	32.3	12
		Fillet	SR-2001-05	L2402109-5	38,923	48.3	7.7
		Fillet	SR-2001-13	L2402109-13	64,923	32.5	5.7
		Carcass	SR-2001-02	L2402109-2	101,018	39.3	42.3
		Carcass	SR-2001-06	L2402109-6	101,420	35.2	50.4
		Carcass	SR-2001-08	L2402109-8	70,033	60.4	15.7
		Carcass	SR-2001-14	L2402109-14	81,884	55.2	20.6
	St. Regis	Fillet	SR-2001-49	L2402113-8	77,600	37.5	15.7
		Fillet	SR-2001-51	L2402113-10	75,385	26.0	37.6
		Fillet	SR-2001-53	L2402113-12	51,020	34.3	16.6
		Fillet	SR-2001-56	L2402113-14	49,839	31.1	17.7
		Carcass	SR-2001-50	L2402113-9	146,377	27.6	41.8
		Carcass	SR-2001-52	L2402113-11	117,419	31.0	60.1
		Carcass	SR-2001-54	L2402113-13	116,774	31.0	49.1
		Carcass	SR-2001-57	L2402113-15	88,337	40.3	33.7
Northern Pike (NP)	Lolo	Fillet	SR-2001-58	L2402113-16	44,606	34.3	23.2
		Fillet	SR-2001-61	L2402113-19	27,004	24.7	15.6
		Fillet	SR-2001-64	L2402113-21	12,532	23.7	16.6
		Fillet	SR-2001-69	L2402113-25	8,502	22.7	25.3
		Carcass	SR-2001-59	L2402113-17	196,899	38.7	48.3
		Carcass	SR-2001-62	L2402113-20	120,433	32.3	65.7
		Carcass	SR-2001-65	L2402113-22	48,355	30.4	61.5
		Carcass	SR-2001-70	L2402113-26	43,357	28.6	40
	Council Grove	Fillet	SR-2001-66	L2402113-23	73,770	24.4	30.6
		Carcass	SR-2001-67	L2402113-24	260,819	34.2	76.2
	Frenchtown	Fillet	SR-2001-03	L2402109-3	181,867	37.5	5.11
		Fillet	SR-2001-09	L2402109-9	87,117	32.6	16.8
		Fillet	SR-2001-18	L2402109-17	140,705	31.2	24.5
		Fillet	SR-2001-20	L2402109-19	56,305	34.1	16.9
		Carcass	SR-2001-04	L2402109-4	731,235	41.3	70.4
		Carcass	SR-2001-11	L2402109-11	292,196	55.1	41.8
		Carcass	SR-2001-19	L2402109-18	276,347	42.7	40.4
		Carcass	SR-2001-21	L2402109-20	180,000	43.0	30.6

PCB = Polychlorinated biphenyl; SDG = Sample Delivery Group

Table 6-2. Toxicity Equivalence Factors (TEFs)

Congener	Humans/ mammals 2005 (b)	Fish 1998 (a)	Birds 1998 (a)
2,3,7,8-Tetrachlorodibenzo- <i>p</i> -dioxin	1	1	1
1,2,3,7,8-Pentachlorodibenzo- <i>p</i> -dioxin	1	1	1
1,2,3,4,7,8-Hexachlorodibenzo- <i>p</i> -dioxin	0.1	0.5	0.05
1,2,3,6,7,8-Hexachlorodibenzo- <i>p</i> -dioxin	0.1	0.01	0.01
1,2,3,7,8,9-Hexachlorodibenzo- <i>p</i> -dioxin	0.1	0.01	0.1
1,2,3,4,6,7,8-Heptachlorodibenzo- <i>p</i> -dioxin	0.01	0.001	< 0.001
1,2,3,4,6,7,8,9-Octachlorodibenzo- <i>p</i> -Dioxin	0.0003	< 0.0001	0.0001
2,3,7,8-Tetrachlorodibenzofuran	0.1	0.05	1
1,2,3,7,8-Pentachlorodibenzofuran	0.03	0.05	0.1
2,3,4,7,8-Pentachlorodibenzofuran	0.3	0.5	1
1,2,3,4,7,8-Hexachlorodibenzofuran	0.1	0.1	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran	0.1	0.1	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran	0.1	0.1	0.1
2,3,4,6,7,8-Hexachlorodibenzofuran	0.1	0.1	0.1
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01	0.01	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.01	0.01	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	0.0003	< 0.0001	0.0001
Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	0.0001	0.0001	0.05
Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	0.0003	0.0005	0.1
Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	0.1	0.005	0.1
Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	0.03	0.00005	0.001
Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	0.00003	< 0.000005	0.0001
Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	0.00003	< 0.000005	0.0001
Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	0.00003	< 0.000005	0.00001
Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	0.00003	< 0.000005	0.00001
Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	0.00003	< 0.000005	0.0001
Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	0.00003	< 0.000005	0.0001
Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	0.00003	< 0.000005	0.00001
Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	0.00003	< 0.000005	0.00001

(a) Van den Berg, et al. (1998)

(b) Van den Berg, et al. (2006)

Table 6-3. 2019 Fish Tissue Sample TEQ Concentrations

Fish Species	Sampling Location (Reach)	Tissue Type	Sample ID	Dioxin/Furan SDG-Lab Sample ID	PCB SDG-Lab Sample ID	Toxicity Equivalence (TEQ) pg/g-dry weight [a]			Percentage Solids	Percentage Lipids
						TEQ _{mammal} (D/F)	TEQ _{mammal} (PCB)	TEQ _{mammal} (D/F/P)		
Rainbow Trout (RB)	Lolo	Fillet	SR-2001-30	E1900931-029	L2402109-29	1.81	0.80	2.61	28.9	20.4
		Fillet	SR-2001-32	E1900931-031	L2402109-31	1.68	0.18	1.86	28.5	13.7
		Fillet	SR-2001-35	E1900931-033	L2402109-33	2.56	0.27	2.83	29.1	20.4
		Fillet	SR-2001-37	E1900931-035	L2402109-35	3.93	0.18	4.11	26	21.6
		Carcass	SR-2001-31	E1900931-030	L2402109-30	2.88	0.51	3.39	32.1	29.4
		Carcass	SR-2001-33	E1900931-032	L2402109-32	1.67	0.52	2.19	32.4	60.5
		Carcass	SR-2001-36	E1900931-034	L2402109-34	1.65	0.31	1.96	36.7	53.4
		Carcass	SR-2001-38	E1900931-036	L2402109-36	1.62	0.21	1.83	34.3	29.1
	Missoula	Fillet	SR-2001-15	E1900931-015	L2402109-15	0.69	1.18	1.87	51.5	11.3
		Fillet	SR-2001-24	E1900931-023	L2402109-23	1.93	2.03	3.96	30.5	38.4
		Fillet	SR-2001-26	E1900931-025	L2402109-25	1.82	0.76	2.58	31.8	43.5
		Fillet	SR-2001-28	E1900931-027	L2402109-27	1.89	0.91	2.79	29.6	39.6
		Carcass	SR-2001-16	E1900931-016	L2402109-16	1.66	2.18	3.84	48.4	24.3
		Carcass	SR-2001-25	E1900931-024	L2402109-24	2.23	1.68	3.91	31.5	35.7
		Carcass	SR-2001-27	E1900931-026	L2402109-26	1.68	1.19	2.87	38.5	68.9
		Carcass	SR-2001-29	E1900931-028	L2402109-28	1.43	1.03	2.45	35	52.8
	Council Grove	Fillet	SR-2001-39	E1900931-037	L2402109-37	1.55	0.66	2.21	31.6	35.2
		Fillet	SR-2001-45	E1900932-004	L2402113-4	1.03	3.84	4.88	36.6	15.6
		Fillet	SR-2001-47	E1900932-006	L2402113-6	1.09	0.45	1.54	34.4	11.3
		Fillet	SR-2001-41	E1900932-001	L2402113-1	1.07	7.65	8.72	31.8	18.5
		Carcass	SR-2001-40	E1900931-038	L2402109-38	2.45	1.55	4.00	36.4	51.6
		Carcass	SR-2001-46 [b]	E2000197-001	L2402113-5	4.38	8.84	13.23	65.2	30.4
		Carcass	SR-2001-48	E1900932-007	L2402113-7	4.30 [c]	1.43	5.73	40.1	4.86
		Carcass	SR-2001-42	E1900932-002	L2402113-2	1.04	6.17	7.20	54.1	35.7
	Frenchtown	Fillet	SR-2001-01	E1900931-001	L2402109-1	1.50	0.43	1.93	31.9	22.9
		Fillet	SR-2001-07	E1900931-007	L2402109-7	1.65	1.87	3.53	32.3	12
		Fillet	SR-2001-05	E1900931-005	L2402109-5	0.66	0.31	0.96	48.3	7.7
		Fillet	SR-2001-13	E1900931-013	L2402109-13	0.63	6.81	7.44	32.5	5.7
		Carcass	SR-2001-02	E1900931-002	L2402109-2	1.64	0.61	2.26	39.3	42.3
		Carcass	SR-2001-06	E1900931-006	L2402109-6	1.60	2.31	3.91	35.2	50.4
		Carcass	SR-2001-08	E1900931-008	L2402109-8	0.71	2.03	2.74	60.4	15.7
		Carcass	SR-2001-14	E1900931-014	L2402109-14	0.85	8.56	9.41	55.2	20.6
	St. Regis	Fillet	SR-2001-49	E1900932-008	L2402113-8	0.87	1.22	2.10	37.5	15.7
		Fillet	SR-2001-51	E1900932-010	L2402113-10	2.52	8.95	11.48	26	37.6
		Fillet	SR-2001-53	E1900932-012	L2402113-12	2.51	7.23	9.73	34.3	16.6
		Fillet	SR-2001-56	E1900932-014	L2402113-14	1.78	6.40	8.18	31.1	17.7
		Carcass	SR-2001-50	E1900932-009	L2402113-9	3.63	18.94	22.57	27.6	41.8
		Carcass	SR-2001-52	E1900932-011	L2402113-11	1.46	15.64	17.10	31	60.1
		Carcass	SR-2001-54	E1900932-013	L2402113-13	3.47	14.40	17.88	31	49.1
		Carcass	SR-2001-57	E1900932-015	L2402113-15	1.39	11.05	12.45	40.3	33.7
Northern Pike (NP)	Lolo	Fillet	SR-2001-58	E1900932-016	L2402113-16	2.19	4.66	6.85	34.3	23.2
		Fillet	SR-2001-61	E1900932-019	L2402113-19	4.19	2.90	7.09	24.7	15.6
		Fillet	SR-2001-64	E1900932-021	L2402113-21	1.91	0.30	2.21	23.7	16.6
		Fillet	SR-2001-69	E1900932-025	L2402113-25	1.32	0.92	2.24	22.7	25.3
		Carcass	SR-2001-59	E1900932-017	L2402113-17	2.10	22.18	24.27	38.7	48.3
		Carcass	SR-2001-62	E1900932-020	L2402113-20	3.31	12.89	16.19	32.3	65.7
		Carcass	SR-2001-65	E1900932-022	L2402113-22	2.41	6.14	8.55	30.4	61.5
		Carcass	SR-2001-70	E1900932-026	L2402113-26	1.80	2.71	4.50	28.6	40
	Council Grove	Fillet	SR-2001-66	E1900932-023	L2402113-23	2.35	8.83	11.18	24.4	30.6
		Carcass	SR-2001-67	E1900932-024	L2402113-24	1.74	31.80	33.55	34.2	76.2
	Frenchtown	Fillet	SR-2001-03	E1900931-003	L2402109-3	1.06	2.91	3.97	37.5	5.11
		Fillet	SR-2001-09	E1900931-009	L2402109-9	1.73	7.30	9.03	32.6	16.8
		Fillet	SR-2001-18	E1900931-017	L2402109-17	1.36	11.81	13.17	31.2	24.5
		Fillet	SR-2001-20	E1900931-019	L2402109-19	1.87	0.99	2.86	34.1	16.9
		Carcass	SR-2001-04	E1900931-004	L2402109-4	3.59	8.12	11.71	41.3	70.4
		Carcass	SR-2001-11	E1900931-011	L2402109-11	1.73	26.42	28.15	55.1	41.8
		Carcass	SR-2001-19	E1900931-018	L2402109-18	1.58	27.37	28.96	42.7	40.4
		Carcass	SR-2001-21	E1900931-020	L2402109-20	1.43	15.19	16.62	43.0	30.6

PCB = Polychlorinated biphenyl; SDG = Sample Delivery Group; D/F = dioxin/furan; TEQ = toxicity equivalence; D/E/P = dioxin/furan/polychlorinated biphenyl

[a] TEQ concentrations shown in this table are calculated as $TEQ = \sum TEQ_i \times \text{Congener}$, evaluating non-detects at 1/2 detection limit.

[b] Results for dioxins/furans are based on the re-analysis of sample SR-2001-46. Results for PCB congeners are based on the original analysis (percent solids of 44.7% and percent lipids of 40%).

[c] Results for three dioxins/furans were rejected during validation. This TEQ concentration was calculated using results of the 14 valid dioxin/furan results for this sample.

Table 6-4. 2018 Fish Tissue Sample Total PCB Concentrations

Fish Species	Sampling Location (Reach)	Tissue Type	Sample ID	PCB SDG- Lab Sample ID	Total PCB (pg/g-dry weight)	Percentage Solids	Percentage Lipids
Rainbow Trout (RB)	Florence	Fillet	47723-41	L2295597-9	18,200	28.4	47.2
		Fillet	47723-42	L2295597-10	12,800	26.8	36.7
		Fillet	47723-43	L2295597-11	8,720	26.3	35.4
		Fillet	47723-44	L2295597-12	7,970	25.4	31.1
		Carcass	47723-45	L2295597-13	17,100	37.6	42.8
		Carcass	47723-46	L2295597-14	15,300	32.1	43.7
		Carcass	47723-47	L2295597-15	8,860	35.2	49.9
		Carcass	47723-48	L2295597-16	8,230	28.2	33.6
	Greenough	Fillet	47723-49	L2299834-29	5,010	26.1	NV
		Fillet	47723-50	L2299834-30	10,200	23.7	26.5
		Carcass	47723-53	L2299834-31	6,580	30	60.7
		Carcass	47723-54	L2299834-32	13,200	26.9	39.6
	Clinton	Fillet	47723-17	L2299834-9	12,900	24.5	29.7
		Fillet	47723-18	L2299834-10	17,600	24.9	28.9
		Fillet	47723-19	L2299834-11	9,790	26.1	36.1
		Fillet	47723-20	L2299834-12	7,860	24.5	30.2
		Carcass	47723-21	L2299834-13	19,000	26	88.4
		Carcass	47723-22	L2299834-14	24,400	27.1	NV
		Carcass	47723-23	L2299834-15	13,400	25.2	49.3
		Carcass	47723-24	L2299834-16	11,000	30.2	49.2
	Missoula	Fillet	47723-25	L2299834-17	81,000	28.8	37.2
		Fillet	47723-26	L2299834-18	56,700	26	32.2
		Fillet	47723-27	L2299834-19	61,700	25.5	22.4
		Fillet	47723-28	L2299834-20	33,600	22.1	17
		Carcass	47723-29	L2299834-21	128,000	30.9	58.4
		Carcass	47723-30	L2299834-22	70,500	28	52.6
		Carcass	47723-31	L2299834-23	89,000	24.4	31.1
		Carcass	47723-32	L2299834-24	62,400	29.4	34.5
	Council Grove	Fillet	47723-34	L2299834-26	92,900	24	20.6
		Carcass	47723-38	L2299834-28	129,000	28.2	37.6
	Frenchtown	Fillet	47723-09	L2295597-1	79,400	27.1	39.4
		Fillet	47723-10	L2295597-2	100,000	26.1	30.2
		Fillet	47723-11	L2295597-3	57,900	26.6	27.6
		Fillet	47723-12	L2295597-4	66,900	26.7	20.9
		Carcass	47723-13	L2295597-5	106,000	28.4	49.3
		Carcass	47723-14	L2295597-6	112,000	36	43.2
		Carcass	47723-15	L2295597-7	89,400	28.5	53.2
		Carcass	47723-16	L2295597-8	106,000	31.6	36.2
	St. Regis	Fillet	47723-01	L2299834-1	100,000	24	19.2
		Fillet	47723-02	L2299834-2	64,600	21.9	19.3
		Fillet	47723-03	L2299834-3	62,200	23.1	22.9
		Fillet	47723-04	L2299834-4	56,400	23.8	23.4
		Carcass	47723-05	L2299834-5	157,000	25.2	32.7
		Carcass	47723-06	L2299834-6	121,000	26.2	38.6
		Carcass	47723-07	L2299834-7	83,300	26.5	29.2
		Carcass	47723-08	L2299834-8	89,500	25.1	29.8
Northern Pike (NP)	Lolo	Fillet	47723-57	L2295597-17	21,000	23.6	19
		Fillet	47723-58	L2295597-18	10,800	24.3	14
		Fillet	47723-59	L2295597-19	5,490	32.2	11.3
		Fillet	47723-60	L2295597-20	2,250	29.4	5.76
		Carcass	47723-61	L2295597-21	35,600	36.7	32.2
		Carcass	47723-62	L2295597-22	24,300	43.1	28.6
		Carcass	47723-63	L2295597-23	8,410	58.1	14.5
		Carcass	47723-64	L2295597-24	7,910	39.1	25.2
	Missoula	Fillet	47723-90	L2299834-36	8,510	25.3	21
		Carcass	47723-91	L2299834-37	31,700	33.1	49
	Council Grove	Fillet	47723-33	L2299834-25	46,700	22.9	14.6
		Carcass	47723-37	L2299834-27	181,000	32.6	59.7
	Frenchtown	Fillet	47723-65	L2295597-25	108,000	39.3	22.4
		Fillet	47723-66	L2295597-26	48,300	41.5	12.6
		Fillet	47723-67	L2295597-27	49,500	48.2	7.78
		Fillet	47723-68	L2295597-28	28,400	32.9	6.57
		Carcass	47723-69	L2295597-29	194,000	52.8	28.8
		Carcass	47723-70	L2295597-30	107,000	54.2	18.3
		Carcass	47723-71	L2295597-31	185,000	38.1	32.4
		Carcass	47723-72	L2295597-32	60,700	52.7	14.6

PCB = Polychlorinated biphenyl; SDG = Sample Delivery Group; NV = no valid value is available.

Table 6-5. 2018 Fish Tissue Sample TEQ Concentrations

Fish Species	Sampling Location (Reach)	Tissue Type	Sample ID	Dioxin/Furan SDG-Lab Sample ID	PCB SDG-Lab Sample ID	Toxicity Equivalence (TEQ) pg/g-dry weight			Percentage Solids	Percentage Lipids
						TEQ _{mammal} (D/F)	TEQ _{mammal} (PCB)	TEQ _{mammal} (D/F/P)		
Rainbow Trout (RB)	Florence	Fillet	47723-41	E1900440-009	L2295597-9	7.45	0.27	7.72	28.4	47.2
		Fillet	47723-42	E1900440-010	L2295597-10	3.66	0.31	3.97	26.8	36.7
		Fillet	47723-43	E1900440-011	L2295597-11	1.79	0.19	1.97	26.3	35.4
		Fillet	47723-44	E1900440-012	L2295597-12	1.76	0.19	1.94	25.4	31.1
		Carcass	47723-45	E1900440-013	L2295597-13	1.72	0.20	1.92	37.6	42.8
		Carcass	47723-46	E1900440-014	L2295597-14	2.40	0.37	2.77	32.1	43.7
		Carcass	47723-47	E1900440-015	L2295597-15	1.26	0.32	1.58	35.2	49.9
		Carcass	47723-48	E1900440-016	L2295597-16	1.90	0.37	2.26	28.2	33.6
	Greenough	Fillet	47723-49	E1900479-029	L2299834-29	0.94	0.21	1.15	26.1	NV
		Fillet	47723-50	E1900479-030	L2299834-30	1.10	0.26	1.36	23.7	26.5
		Carcass	47723-53	E1900479-031	L2299834-31	0.77	0.37	1.14	30	60.7
		Carcass	47723-54	E1900479-032	L2299834-32	1.00	0.19	1.19	26.9	39.6
	Clinton	Fillet	47723-17	E1900479-009	L2299834-9	0.80	0.42	1.21	24.5	29.7
		Fillet	47723-18	E1900479-010	L2299834-10	0.93	0.40	1.33	24.9	28.9
		Fillet	47723-19	E1900479-011	L2299834-11	3.44	0.47	3.90	26.1	36.1
		Fillet	47723-20	E1900479-012	L2299834-12	1.26	0.26	1.52	24.5	30.2
		Carcass	47723-21	E1900479-013	L2299834-13	1.74	0.71	2.45	26	88.4
		Carcass	47723-22	E1900479-014	L2299834-14	2.35	0.59	2.93	27.1	NV
		Carcass	47723-23	E1900479-015	L2299834-15	0.90	0.26	1.15	25.2	49.3
		Carcass	47723-24	E1900479-016	L2299834-16	1.31	0.46	1.77	30.2	49.2
	Missoula	Fillet	47723-25	E1900479-017	L2299834-17	1.24	1.25	2.49	28.8	37.2
		Fillet	47723-26	E1900479-018	L2299834-18	1.21	1.05	2.26	26	32.2
		Fillet	47723-27	E1900479-019	L2299834-19	1.23	1.42	2.65	25.5	22.4
		Fillet	47723-28	E1900479-020	L2299834-20	2.47	0.47	2.94	22.1	17
		Carcass	47723-29	E1900479-021	L2299834-21	1.24	1.15	2.39	30.9	58.4
		Carcass	47723-30	E1900479-022	L2299834-22	17.01	0.71	17.72	28	52.6
		Carcass	47723-31	E1900479-023	L2299834-23	1.41	1.59	3.00	24.4	31.1
		Carcass	47723-32	E1900479-024	L2299834-24	0.96	0.51	1.47	29.4	34.5
	Council Grove	Fillet	47723-34	E1900479-026	L2299834-26	0.99	0.92	1.91	24	20.6
		Carcass	47723-38	E1900479-028	L2299834-28	0.96	1.22	2.18	28.2	37.6
	Frenchtown	Fillet	47723-09	E1900440-001	L2295597-1	2.48	1.40	3.88	27.1	39.4
		Fillet	47723-10	E1900440-002	L2295597-2	2.62	1.56	4.18	26.1	30.2
		Fillet	47723-11	E1900440-003	L2295597-3	2.11	0.66	2.77	26.6	27.6
		Fillet	47723-12	E1900440-004	L2295597-4	2.26	0.54	2.80	26.7	20.9
		Carcass	47723-13	E1900440-005	L2295597-5	2.18	1.49	3.68	28.4	49.3
		Carcass	47723-14	E1900440-006	L2295597-6	1.52	1.46	2.98	36	43.2
		Carcass	47723-15	E1900440-007	L2295597-7	2.68	0.95	3.64	28.5	53.2
		Carcass	47723-16	E1900440-008	L2295597-8	1.27	1.25	2.52	31.6	36.2
	St. Regis	Fillet	47723-01	E1900479-001	L2299834-1	1.92	2.96	4.89	24	19.2
		Fillet	47723-02	E1900479-002	L2299834-2	2.37	1.21	3.58	21.9	19.3
		Fillet	47723-03	E1900479-003	L2299834-3	2.23	1.16	3.39	23.1	22.9
		Fillet	47723-04	E1900479-004	L2299834-4	0.83	0.99	1.82	23.8	23.4
		Carcass	47723-05	E1900479-005	L2299834-5	1.10	2.52	3.61	25.2	32.7
		Carcass	47723-06	E1900479-006	L2299834-6	1.16	2.43	3.59	26.2	38.6
		Carcass	47723-07	E1900479-007	L2299834-7	1.05	1.75	2.81	26.5	29.2
		Carcass	47723-08	E1900479-008	L2299834-8	0.94	2.03	2.97	25.1	29.8
Northern Pike (NP)	Lolo	Fillet	47723-57	E1900440-017	L2295597-17	1.98	0.79	2.77	23.6	19
		Fillet	47723-58	E1900440-018	L2295597-18	1.48	0.41	1.89	24.3	14
		Fillet	47723-59	E1900440-019	L2295597-19	1.47	0.28	1.76	32.2	11.3
		Fillet	47723-60	E1900440-020	L2295597-20	0.97	0.09	1.06	29.4	5.76
		Carcass	47723-61	E1900440-021	L2295597-21	10.58	1.36	11.94	36.7	32.2
		Carcass	47723-62	E1900440-022	L2295597-22	4.73	0.97	5.70	43.1	28.6
		Carcass	47723-63	E1900440-023	L2295597-23	0.82	0.37	1.19	58.1	14.5
		Carcass	47723-64	E1900440-024	L2295597-24	1.05	0.38	1.44	39.1	25.2
	Missoula	Fillet	47723-90	E1900479-036	L2299834-36	1.59	0.28	1.87	25.3	21
		Carcass	47723-91	E1900479-037	L2299834-37	1.40	1.02	2.41	33.1	49
	Council Grove	Fillet	47723-33	E1900479-025	L2299834-25	1.06	0.54	1.59	22.9	14.6
		Carcass	47723-37	E1900479-027	L2299834-27	1.67	3.00	4.67	32.6	59.7
	Frenchtown	Fillet	47723-65	E1900440-025	L2295597-25	1.20	2.29	3.49	39.3	22.4
		Fillet	47723-66	E1900440-026	L2295597-26	0.91	1.20	2.11	41.5	12.6
		Fillet	47723-67	E1900440-027	L2295597-27	1.14	1.30	2.44	48.2	7.78
		Fillet	47723-68	E1900440-028	L2295597-28	1.39	0.69	2.08	32.9	6.57
		Carcass	47723-69	E1900440-029	L2295597-29	3.42	4.17	7.59	52.8	28.8
		Carcass	47723-70	E1900440-030	L2295597-30	2.30	2.60	4.90	54.2	18.3
		Carcass	47723-71	E1900440-031	L2295597-31	2.05	4.03	6.08	38.1	32.4
		Carcass	47723-72	E1900440-032	L2295597-32	0.73	1.53	2.26	52.7	14.6

PCB = Polychlorinated biphenyl; SDG = Sample Delivery Group; D/F = dioxin/furan; TEQ = toxicity equivalence; D/F/P = dioxin/furan/polychlorinated biphenyl; NV = no valid value is available.

Table 6-6. 2018 and 2019 Fish Specimens Collected

Species	River	Reach Name	2018						2019					
			N Fish	Fish Length		Fish Weight		N Composite Samples (N Fish/ Composite)	N Fish	Fish Length		Fish Weight		N Composite Samples (N Fish/ Composite)
				Average	Range	Average	Range			Average	Range	Average	Range	
Rainbow Trout (RB)	Clark Fork River	St. Regis	20	340	255-410	362	180-510	4 (5)	20	362	280-428	496	252-708	4 (5)
		Frenchtown	20	363	304-415	495	305-850	4 (5)	20	349	272-450	449	210-790	4 (5)
		Council Grove	4	316	267-398	325	200-535	1	20	353	258-432	477	180-800	4 (5)
		Missoula	19	354	249-419	442	170-650	4 (5) [b]	20	345	264-450	470	196-940	4 (5)
		Clinton	20	347	236-417	431	145-730	4 (5)	0	n/a				
	Bitterroot River	Florence/Lolo [a]	20	352	295-422	446	245-720	4 (5)	20	344	255-430	447	180-728	4 (5)
	Blackfoot River	Greenough	8	264	215-387	229	95-690	2 (2)[6] [c]	0	n/a				
Northern Pike (NP)	Clark Fork River	St. Regis	0	n/a					0	n/a				
		Frenchtown	20	662	300-930	2,508	190-6,400	4 (5)	20	708	550-1,020	2,900	1,300-8,180	4 (5)
		Council Grove	1	865	865	5,555	5,555	1 (1)	1	720	720	3,470	3,470	1(1)
		Missoula	1	681	681	2,120	2,120	1(1)	0	n/a				
		Clinton	0	n/a					0	n/a				
	Bitterroot River	Lolo	20	547	324-771	1,392	225-3,735	4 (5)	20	649	470-930	2,455	780-6,440	4 (5)
	Blackfoot River	Greenough	0	n/a					0	n/a				

n/a = not applicable; no fish were collected from this reach.

[a] In 2018, RB specimens were collected from the Bitterroot River at a sampling location upstream from the Lolo sampling location.

[b] Because only 19 RB were collected from the Missoula reach in 2018, one of the four composites was comprised of only 4 fish; all other composites from this reach were comprised of 5 fish.

[c] Because only 8 RB were collected from the Greenough reach in 2018, only two composite samples were possible. Based on the way the fish were submitted by MFWP to ESAT, one composite was comprised of 2 fish and the other composite was comprised of six fish.

Table 6-7. Comparison of Fish Fillet Tissue Concentrations between 2018 and 2019 Fish Samples

Fish Species	Sampling Location (Reach)	Sample ID		Average Length (mm)		Total PCBs (pg/g ww)		TEQ Concentrations - ND=1/2DL (pg/g ww)						TEQ Concentrations - ND=0 (pg/g ww)					
								TEQ _{mammal} (D/F)		TEQ _{mammal} (PCB)		TEQ _{mammal} (D/F/P)		TEQ _{mammal} (D/F)		TEQ _{mammal} (PCB)		TEQ _{mammal} (D/F/P)	
		2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Rainbow Trout (RB)	Florence	47723-41	SR-2001-30	390	408	5,169	2,830	2.11	0.52	0.08	0.23	2.19	0.75	1.81	0.01	0.02	0.01	1.82	0.02
		47723-42	SR-2001-32	393	378	3,430	3,580	0.98	0.48	0.08	0.05	1.06	0.53	0.30	0.03	0.01	0.04	0.31	0.07
		47723-43	SR-2001-35	322	317	2,293	2,840	0.47	0.74	0.05	0.08	0.52	0.82	0.21	0.12	0.01	0.01	0.22	0.13
		47723-44	SR-2001-37	305	273	2,024	1,630	0.45	1.02	0.05	0.05	0.49	1.07	0.08	0.03	0.01	0.01	0.09	0.04
	Greenough	47723-49		353		1,308		0.25		0.06		0.30		0.01		0.005		0.02	
		47723-50		235		2,417		0.26		0.06		0.32		0.02		0.05		0.07	
	Clinton	47723-17		393		3,161		0.20		0.10		0.30		0.002		0.05		0.05	
		47723-18		372		4,382		0.23		0.10		0.33		0.002		0.05		0.06	
		47723-19		346		2,555		0.90		0.12		1.02		0.50		0.11		0.61	
		47723-20		277		1,926		0.31 [a]		0.06		0.37		0 [a]		0.01		0.01	
	Missoula	47723-25	SR-2001-15	391	282	23,328	6,730	0.36	0.36	0.36	0.61	0.72	0.97	0.10	0.03	0.32	0.60	0.42	0.63
		47723-26	SR-2001-24	375	414	14,742	11,400	0.32	0.59	0.27	0.62	0.59	1.21	0.04	0.15	0.23	0.06	0.27	0.20
		47723-27	SR-2001-26	353	361	15,734	14,500	0.31	0.58	0.36	0.24	0.68	0.82	0.04	0.05	0.34	0.07	0.39	0.11
		47723-28	SR-2001-28	283	322	7,426	5,310	0.55	0.56	0.10	0.27	0.65	0.83	0.28	0.24	0.03	0.02	0.31	0.26
	Council Grove	47723-34	SR-2001-39	316	418	22,296	26,500	0.24 [a]	0.49	0.22	0.21	0.46	0.70	0 [a]	0.06	0.09	0.13	0.09	0.19
			SR-2001-41		390		22,100		0.34 [a]		2.43		2.77		0 [a]		2.41		2.41
			SR-2001-45		335		14,800		0.38 [a]		1.41		1.78		0 [a]		1.38		1.38
			SR-2001-47		270		13,500		0.38 [a]		0.15		0.53		0 [a]		0.06		0.06
	Frenchtown	47723-09	SR-2001-01	390	420	21,517	16,100	0.67	0.48	0.38	0.14	1.05	0.62	0.05	0.0002	0.346	0.13	0.40	0.13
		47723-10	SR-2001-05	403	362	26,100	18,800	0.68	0.32 [a]	0.41	0.15	1.09	0.47	0.05	0 [a]	0.375	0.14	0.43	0.14
		47723-11	SR-2001-07	339	326	15,401	21,300	0.56	0.53	0.18	0.61	0.74	1.14	0.05	0.161	0.054	0.58	0.11	0.74
		47723-12	SR-2001-13	319	287	17,862	21,100	0.60	0.20	0.15	2.21	0.75	2.42	0.09	0.057	0.063	2.20	0.15	2.26
	St. Regis	47723-01	SR-2001-49	381	413	24,000	29,100	0.46	0.33 [a]	0.71	0.46	1.17	0.79	0.25	0 [a]	0.710	0.13	0.96	0.13
		47723-02	SR-2001-51	344	371	14,147	19,600	0.52	0.66	0.26	2.33	0.78	2.98	0.07	0.341	0.264	2.31	0.33	2.65
		47723-03	SR-2001-53	339	356	14,368	17,500	0.51	0.86	0.27	2.48	0.78	3.34	0.17	0.699	0.249	2.46	0.42	3.16
		47723-04	SR-2001-56	293	310	13,423	15,500	0.20	0.55	0.24	1.99	0.43	2.54	0.03	0.076	0.227	1.98	0.26	2.05
Northern Pike (NP)	Lolo	47723-57	SR-2001-58	689	814	4,956	15,300	0.47	0.75	0.19	1.60	0.65	2.35	0.08	0.46	0.19	1.57	0.26	2.02
		47723-58	SR-2001-61	618	670	2,624	6,670	0.36	1.03 [a]	0.10	0.72	0.46	1.75	0.05	0 [a]	0.10	0.70	0.15	0.70
		47723-59	SR-2001-64	512	586	1,768	2,970	0.47	0.45	0.09	0.07	0.57	0.52	0.09	0.02	0.09	0.01	0.18	0.03
		47723-60	SR-2001-69	367	526	662	1,930	0.28	0.30 [a]	0.03	0.21	0.31	0.51	0.07	0 [a]	0.03	0.20	0.10	0.20
	Missoula	47723-90		681		2,153		0.40		0.07		0.47		0.03		0.06		0.09	
	Council Grove	47723-33	SR-2001-66	865	720	10,694	18,000	0.24	0.57	0.12	2.15	0.36	2.73	0.01	0.02	0.04	2.12	0.05	2.14
		47723-65	SR-2001-03	827	852	42,444	68,200	0.47	0.40	0.90	1.09	1.37	1.49	0.18	0.06	0.90	1.01	1.08	1.08
	Frenchtown	47723-66	SR-2001-09	666	759	20,045	28,400	0.38	0.56	0.50	2.38	0.88	2.94	0.06	0.10	0.50	2.36	0.56	2.46
		47723-67	SR-2001-18	737	658	23,859	43,900	0.55	0.43	0.63	3.69	1.18	4.11	0.28	0.04	0.63	3.66	0.90	3.70
		47723-68	SR-2001-20	419	563	9,344	19,200	0.46	0.64	0.23	0.34	0.68	0.97	0.11	0.002	0.23	0.32	0.33	0.32

TEQ = toxicity equivalence; DL = detection limit; ND = not detected or non-detect; ww = wet weight; D/F = dioxin/furan; PCB = polychlorinated biphenyl; D/F/P = dioxin/furan/polychlorinated biphenyl

[a] No congener was detected in this sample.